OPERATIONS AND MAINTENANCE PLAN

WAUKEGAN HARBOR REMEDIAL ACTION
WAUKEGAN HARBOR SUPERFUND SITE
WAUKEGAN, ILLINOIS

REVISION NO. 1.0
JANUARY 1997

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1.0 INTRODUCTION

This document constitutes the Operation and Maintenance (O&M) Plan for Waukegan Harbor Superfund Site (Site). The Site is located in Waukegan, Illinois, as shown on Figure 1. The operation and maintenance requirements of this Plan commenced within 30 days of the completion for the final cap of each containment cell (with respect to that cell). The operation and maintenance program is subject to modification pursuant to Section V.D.9 of the Consent Decree. Revision 1.0 incorporates the following items into the O&M Plan:

- Modifications to sampling, inspection, and maintenance procedures since the start of operations and maintenance.
- Clarification of certain requirements of the O&M Plan.
- Quality assurance protocols and procedures specifically tailored for the ongoing, long-term operation and maintenance activities. Appendix A presents these protocols as a Quality Assurance Project Plan (QAPP).
- Health and safety protocols for the ongoing, long-term operation and maintenance activities in the form of a Health and Safety Plan (HASP; Appendix B).
- Replacement of a portable water treatment system with three fixed, liquid-phase carbon treatment systems (one at each containment cell). The three systems are functionally equivalent except for the size of the carbon beds (the Slip No. 3 containment cell system has a 400-pound carbon bed capacity while the other two systems have a 600-pound carbon capacity each). Appendices C, D, and E provide information on the treatment systems, including an operation manual.

The remedial construction activities at the Site were completed to treat or isolate site sediments and soils contaminated with elevated levels of polychlorinated biphenyls (PCBs) pursuant to a Consent Decree between the United States Environmental Protection Agency (US EPA), the Illinois Environmental Protection Agency (IEPA) and Outboard Marine Corporation (OMC) (entered in the District Court for the Northern District of Illinois on April 27, 1989; Case 88C8571). The majority of the construction activities were completed in the Fall 1994, upon placement of the cover and initial dewatering at the Slip No. 3 Containment Cell.

The construction activities included the installation of three containment cells that have the following components requiring ongoing operation and maintenance:

- Three separate soil-bentonite slurry wall-enclosed containment cells with covers,
- Groundwater extraction wells (R-1 to R-6)
- Groundwater piezometers (P-1 to P-12),
- Groundwater monitoring wells (W-1 to W-12),
- Water treatment facilities, and
- A Temporary Designated Soil Stockpile.

The three containment cells are designated as the Slip No. 3 Containment Cell, West Containment Cell, and East Containment Cell (Figure 2). The containment cells encompass areas of approximately 1.5 acres, 3.4 acres, and 5.5 acres, respectively, and are covered with a combination of bituminous concrete and vegetative covers. Table 1 summarizes the composition of each cell cover. Figures 3 to 5 present layouts of the key features of each containment cell. Additional details on the containment cells' construction may be found in the Construction Completion Report (prepared by Canonie Environmental, Inc.).

Groundwater extraction wells in each containment cell are pumped as needed to reduce water levels within the containment cells (inside the slurry walls). The extraction wells are capable of providing an inward hydraulic gradient by maintaining the water level within the cell at a lower hydraulic level than the natural groundwater level outside the cell. The frequency of pumping is based on periodic measurement of water levels inside and outside the slurry walls, procedures in Section 4.0, and schedules agreed upon with US EPA. The water treatment facilities treat the groundwater extracted from each containment cell prior to discharge.

Piezometers within each cell are paired with groundwater monitoring wells outside the cell. The monitoring well/piezometer pairs are used to monitor the groundwater elevation on either side of the slurry walls. The difference in elevation inside and outside the slurry walls provides an estimate of the hydraulic gradient across each containment cell boundary. The groundwater monitoring wells also are used to sample the groundwater immediately outside each containment cell soil-bentonite wall.

The operation and maintenance of the water extraction and treatment systems, containment cell covers, and groundwater monitoring devices will continue for the period provided by Section V.D.9 of the Consent Decree. The program includes a regular inspection and monitoring schedule as described in Section 2.0. An indication of PCBs in the monitoring well system will be assessed under the compliance procedures in Section 3.0, and if the results suggest the soil-bentonite wall is failing to operate as designed (i.e., to contain the materials within the cell), the wall will be repaired subject to approval of the US EPA.

During construction of a new slip to replace Slip No. 3 for Larsen Marine Services, soil contaminated with polynuclear aromatic hydrocarbons (PNAs) was discovered. These PNA contaminants relate to another site, the Waukegan Manufactured Gas and Coke Plant Site, which is being investigated and

remediated separately. Some contaminated soil had to be removed to complete construction for the Waukegan Harbor Remedial Action. The removed soils were placed in a temporary stockpile lined and covered with high density polyethylene. This stockpile is called the Temporary Designated Soil Stockpile. The stockpile will be maintained as part of the Waukegan Harbor Superfund Remedial Action until its final disposition is determined as part of the remedial action for the Waukegan Manufactured Gas and Coke Plant Site. Once a permanent remedy is implemented for the stockpile, operation and maintenance activities under the Waukegan Harbor Site Remedial Action will cease. This O&M Plan addresses required activities for this stockpile in Appendix F.

In accordance with Section V.D.9 of the Consent Decree, OMC may request that US EPA modify or terminate any requirements of this operation and maintenance. Any requests will describe the proposed modification or termination and demonstrate that continuation of the activity to be modified or terminated is not necessary to protect human health or the environment. Such modifications or terminations will take effect upon a written approval of US EPA (with the concurrence of IEPA).

2.0 MAINTENANCE AND INSPECTION OF FINAL COVER

For each of the three containment cells, the top surface of the final cover consists of either bituminous concrete or top soil overlying a drainage layer and an HDPE synthetic liner (or some combination). The top surface of the cover will be inspected in accordance with the following schedules, and repairs will be completed as soon as practical after discovery of need for repair, weather conditions permitting.

Areas where bituminous concrete cover is installed will be inspected each spring during the post-closure care period. Cracks will be sealed with asphalt sealer. Potholes or other deterioration of the asphalt surface will be repaired using procedures recommended by the Asphalt Institute in MS-16 (Asphalt Pavement Maintenance, 1967).

The vegetative cover will be inspected each spring during the post-closure care period. Any gullies or washouts in the top soil cover will be backfilled, compacted, reseeded, and mulched with an appropriate material. Any areas of dead or distressed vegetation will be similarly treated. Lined or rip-rapped drains will be installed if persistent erosion recurs in the same location.

At a minimum, areas where a vegetation and topsoil cover is installed will be mowed twice per growing season. In addition, vegetative cover areas will be fertilized occasionally as needed to maintain healthy growth. In any given year, fertilization may be over the entire area, or only in localized distress areas, or not at all, depending on the findings of the annual cover inspection.

If it becomes necessary to excavate into the containment cells or if damage otherwise occurs to the drainage layer or synthetic liner, the following repair procedures will be followed:

1. The synthetic surface will be exposed and inspected for signs of physical damage (punctures, slits or tears). This may require cutting and removing or rolling back the synthetic drainage materials.

2. The liner will be exposed at least 12 inches in all directions from the damaged area.

3. In the case of a puncture, the damaged area will be repaired by the application of extruded material or a glued patch.

4. For a tear, slit or large puncture, the flaw will be overlain by a panel of the same material that will be bonded to the existing liner by an extrudate weld or by glueing.

5. The extrudate weld or glued seam will be checked using a vacuum box.

6. The synthetic filter or drainage layer will be replaced and fastened in place to the existing drainage layer.

3.0 GROUNDWATER MONITORING

The groundwater monitoring wells were installed after completion of the soil-bentonite slurry wall at each containment cell. The wells are labeled with permanent weatherproof designations. Twelve groundwater monitoring wells will be sampled and analyzed for PCBs quarterly for the first two years and semiannually for the remainder of the post-closure period, unless otherwise modified pursuant to Section V.D.9 of the Consent Decree. Semiannual sampling commenced April 1996 for all three containment cells. Background analysis was established by the first four quarterly sampling events occurring after well installation, which are summarized in Table 2.

3.1 Groundwater Elevations

The groundwater elevations in each of the piezometer/groundwater monitoring well pairs will be measured quarterly and recorded on the groundwater level data log included in the Quality Assurance Project Plan (QAPP; Appendix A). The measurements will be used to evaluate the extraction well pumping frequency to reduce water levels within the containment cells.

The hydraulic gradient between a containment cell and the groundwater outside the slurry wall is represented by the overall difference in water level across the width of the cell. Based on the smaller volume of water storage available per unit cross-section of recharge area, water will accumulate more rapidly at the corners of the containment cells than across the length and center of the cells. Therefore, the present locations of well-piezometer pairs at or near the corners of the slurry walls provide a conservative measure of the differential between the interior and exterior water levels.

The frequency of measuring and recording water levels may be reduced, as approved by US EPA, if the rate of change in water elevations is less than an average of six inches per month. Conversely, the frequency may be increased to account for changes that may result from changes in weather or exterior water levels.

3.2 Groundwater Sampling, Analysis, and Notifications

The groundwater monitoring program consists of detection monitoring, compliance monitoring, and corrective action programs. The detection monitoring program addresses the routine, ongoing monitoring of the containment cell function. Compliance monitoring will be implemented if detection monitoring identifies a change that may suggest a deterioration in the function of any containment cell. If compliance monitoring determines that contaminants within a containment cell are migrating beyond the slurry walls, then corrective action will be taken.

Groundwater detection monitoring, compliance monitoring, and corrective action programs will be completed as follows:

1. Hazardous Constituents - Groundwater monitoring will be for PCBs. Analyses for PCBs will be by gas chromatograph by EPA Method 8081 in accordance with procedures described in the Quality Assurance Project Plan (QAPP) for operations and maintenance, attached as Appendix A. Groundwater sampling will be completed in accordance with the QAPP standard operating procedures (Appendix A, Attachments 2 and 3), including completing field analyses for pH, conductivity, and temperature during purging (to verify that the water quality has stabilized before sample collection). The purge water from groundwater sampling will be discharged on the ground surface unless analyses from the previous sampling event indicated PCB concentrations of more than 0.010 ppm (10 μg/l). Such water will be collected and either recharged into the containment cells through the sump in the treatment systems or treated with the fixed treatment systems prior to discharge. The QAPP also includes record keeping and chain-of-custody requirements for the sampling program.

2. Well Locations - The monitoring wells are located within about 20 feet of the soil-bentonite walls enclosing each in-place containment cell (Figures 2 - 5). Each monitoring well is paired with a piezometer installed approximately 5 feet inside the soil-bentonite wall so that the differential water level across the soil-bentonite wall may be determined.

3. Compliance Period - The operation and maintenance program will continue for the period in Section V.D.9 in the Consent Decree.

4. Detection Monitoring - Groundwater samples from the monitoring wells will be analyzed for PCBs by US EPA Method 8081 during detection monitoring. The detection limit will be 1 ppb (1 μg/l). The following criteria will be used for further assessment of groundwater sampling results:

    - If reported values for all the monitoring wells surrounding a given containment cell are below background levels for at least three consecutive semi-annual sampling events, the monitoring frequency may be reduced to annually, pending US EPA approval of a written request.

    - Reported values for PCB sampling of 1 ppb to 5 ppb above background will be noted internally for reassessment at the next monitoring event. Internal review, tabulation, and comparison of the data relative to the applicable well's background value constitute noting for reassessment. If the subsequent sampling result is at or below the background value, detection monitoring will continue. If the result is again above background, the monitoring point will be assessed in accordance with the other assessment criteria described below.

- A PCB sampling result of more than 5 ppb above background will be verified by resampling and analysis within two weeks of receiving the laboratory results. A second result greater than 5 ppb above background will shift the groundwater monitoring program into compliance monitoring, as provided in paragraph 5. For the monitoring data record, the original sampling result will be recorded if it is verified. If the original result it is not verified, the resampling result will be recorded.

- If the detection monitoring results indicate that the PCB level is consistently above the background level by less than 5 ppb and shows a continuing increase at a rate of 1 ppb or more for three consecutive sampling events, the groundwater monitoring program will move into compliance monitoring, as provided in paragraph 5.

The US EPA will be provided written notification of a shift to compliance monitoring within 30 days of confirmation that compliance monitoring is required. If the detection monitoring change in PCB level is greater than 10 ppb above background, then the US EPA shall be notified by phone within 24 hours of confirmation of the detection monitoring results. Confirmation is defined by receipt of a verified resampling result that is 5 ppb or more above background or receipt of the fourth sequential validated sampling result that shows a continued increase in PCB concentration of 1 ppb or more per sampling period.

5. Compliance Monitoring - Within 30 days of the notification described in paragraph 4, a Compliance Monitoring Plan will be submitted to the US EPA for approval prior to implementation. Compliance monitoring may include, but is not limited to, any of the following types of activities:
   - an increase in the frequency of monitoring,
   - the installation of additional temporary or permanent monitoring well points along the boundary,
   - in-situ collection of water or soil samples from discrete depths (e.g., Hydropunch®-type sampling),
   - geophysical-type techniques to evaluate the condition of the slurry wall and/or cover.

The compliance monitoring plan shall include locations and construction details for any additional groundwater monitoring points, successive/additional monitoring activities to be taken based on the results of the initial compliance monitoring, and a schedule for compliance monitoring. The results of the compliance monitoring program will be used to evaluate if PCBs are migrating from the in-place containment area and, if so, to assess the location from which the PCBs are emanating.

Following completion of the activities described in the Compliance Monitoring Plan, an Assessment Report will be prepared discussing whether PCBs are migrating from the containment cells and describing what, if any, corrective action measures are necessary. The Assessment Report shall be prepared in accordance with a schedule contained in the approved

Compliance Monitoring Plan and shall be submitted to US EPA for approval. If the containment cells are determined to be functioning properly or the PCB detections are determined to be caused by an event or source outside the containment cells, US EPA and OMC will also evaluate whether any further actions are required and under what regulatory program such actions should be conducted.

6. Corrective Action Program - If the Assessment Report indicates that corrective action is required, such corrective action will be carried out in accordance with this paragraph. The corrective action program may include but is not limited to increased pumping frequency or rate, repair of the soil-bentonite wall by reexcavation and reinstallation, drilling and grouting, vibratory beam grouting, or other repair methods. The details of the proposed corrective action, including the quality control and assurance procedures and the monitoring procedures required to verify the corrective action (the "Corrective Action Plan"), will be submitted to the US EPA for approval within 60 days of approval of the Assessment Report.

   Corrective action will begin within 60 days of receiving US EPA approval for corrective action and will proceed in accordance with the schedule in the approved Corrective Action Plan.

The US EPA will have access to observe the regular sampling and to obtain split samples during regular well sampling. The US EPA will have access at other times if first prearranged with OMC by written request and if OMC is allowed to observe and enforce compliance with proper sampling procedures and to obtain split samples. As per the consent decree, 10 days notice will be provided of newly scheduled sampling activities. One notice shall be sufficient if multiple activities are planned and/or sampling is scheduled to extend over multiple days or weeks. Short breaks (e.g., several days to a couple weeks) in the activities described in the original notice or required due to field conditions shall not require formal re-notification. Every attempt, though, will be made to be flexible and coordinate schedules with agency oversight staff.

In order to allow resampling as close as possible to the original sampling date for a well that has a detection above background (pursuant to paragraph 4 above), the original sampling notice will be considered still to apply and only a verbal notice of the resampling date need be given. Reasonable efforts will also be made to be flexible and coordinate with US EPA if oversight staff have a conflict with the proposed schedule. Sampling may occur sooner than ten days after notice or resampling may occur later than two weeks from receipt of data if approved by the US EPA.

3.3 Monitoring Well Maintenance

The groundwater monitoring wells will be sounded annually to determine if the well is open. Sounding will be completed with a string and steel weight or a weighted water level tape. The weight and tape will be washed with soap and water wash and distilled/deionized water rinse between wells. If string is used, it will be discarded and fresh, new string used for each well.

If the soundings do not record the correct total depth (based on well installation and maintenance records) or the depth measurement suggests that sediment were accumulating in a well, that well will be redeveloped using a bailer and/or pump according to standard operating procedures provided in the QAPP (Appendix A). Wells that exhibit poor hydraulic performance during sampling will also be redeveloped. Sampling will not occur for at least two weeks after redevelopment of the well, unless approved in advance by US EPA.

If an obstruction appears to be present in the well that cannot be removed by redevelopment of the well, or other damage (such as a bent standpipe) occurs, or if the well continues to perform poorly following redevelopment, the well will be repaired (if possible) or replaced. A replacement well will be installed within 25 feet of the existing well, unless another location is approved by US EPA. The former well will be decommissioned in accordance with Illinois Administrative Code, Chapter I, Part 920.120, "Abandoned Wells.

The elevation of the reference point on each monitoring well will be resurveyed at least once every five years. The top elevation will also be resurveyed if modifications are made to the well or if the well is inadvertently damaged.

4.0 GROUNDWATER EXTRACTION, TREATMENT AND DISCHARGE

Groundwater will be extracted from the recovery wells in each containment cell as needed to lower the water level inside the slurry walls. Extracted groundwater will be processed through each cell's fixed long-term water treatment facility. The treated water will be discharged to the Harbor or the North Ditch on-site. Figures 3 to 5 include the locations of the recovery well, treatment systems, and discharge piping.

The long-term water treatment facilities each include a filter to remove suspended sediment and two carbon adsorption units connected in series. Appendix C contains an example operation manual for the systems that includes a description of key system features, operational and maintenance procedures, troubleshooting guidelines, and drawings of the systems' design.

The treatment systems are equipped with secondary containment, detection sumps, and automatic shut-off controls. The treatment buildings serve as the secondary containment. Appendix E includes containment volume calculations for the fixed treatment buildings. Each building is equipped with a sump that can be drained back inside the containment cells and a flashing light shut-off alarm mounted on top of the building. If water spills from the carbon units or the connecting piping, a high level alarm in the detection sump will cut off electrical power to all extraction pumps. The light alarm will be tripped if excess water is detected in the sump or if the system pressure readings exceed the preset operational guidelines. OMC security guards conduct regular surveys of the property every day and are instructed to notify the appropriate Waukegan Harbor Project staff in the event an alarm is tripped.

4.1 Treatment System Operation

The fixed treatment systems are designed to allow extraction from an individual recovery well in a containment cell or multiple wells concurrently. The systems have automatic shut-offs for excess pressure and built in flow restrictors that limit the maximum pumping rate. The treatment systems are equivalent except for the carbon vessel size and the maximum inflow rate. The Slip No. 3 Containment Cell system has two-200 pound carbon tanks (400 pounds total) with a maximum pumping rate of 15 gallons per minute (gpm) while the East and West Containment Cell systems each have two-300 pound carbon tanks (600 pounds total) with a maximum pumping rate of 20 gpm.

Unless otherwise approved by US EPA, the pumping frequency for each containment cell will be at a rate that maintains an overall inward hydraulic gradient across the soil-bentonite slurry wall. The average PCB concentration in the final effluent discharged shall not exceed a 1 ppb 30-day running average when waste water is generated. In accordance with Section V.D.9 of the Consent Decree, OMC may request that US EPA modify or terminate the groundwater extraction, treatment, or discharge activities for that cell at any time after five years following commencement of operation and maintenance activities for any containment cell. Furthermore, at any time, a request may be made to temporarily modify or terminate operation and maintenance activities for the purpose of gathering data to support such a permanent request.

After five years from the date of the Certificate of Completion of the Work, pursuant to Section XXIV of the Consent Decree, US EPA may establish different effluent limitations for the discharge water if it determines that such limitations may be achieved by the use of the best available technology. Any such determination by US EPA shall be subject to dispute resolution procedures in Section XII of the Consent Decree.

4.2 Treatment System Sampling Frequency

If a long-term water treatment system is operated on an intermittent basis, at least one water sample will be collected between the two carbon units at both the start and the end of the operational cycle. Appendix D contains carbon loading projections that support the sampling schedule. Samples shall be analyzed for PCBs in accordance with the QAPP (Appendix A). The treatment systems shall be sampled on the following schedule for each pumping cycle:

- An initial effluent and lead carbon sample within two days of restarting a system after a shutdown of 30 days or more.
- An effluent sample after one month of running.
- Quarterly effluent samples thereafter for the first two operating cycles of the treatment systems. If the monitoring data for two operating cycles for any containment cell's fixed system demonstrate that it is operating effectively to meet the discharge standard and the influent samples concentrations are all equal to or less than 10 ppb, the required sampling frequency for that system will be reduced to every six months in subsequent years.
- A final effluent and lead carbon sampling within the week prior to shutdown of the system for an extended period of time (e.g., before winterization).

If any lead carbon or effluent sample equals, or exceeds 1 ppb, two additional samples will be collected within the next two weeks. If these additional samples also exceed 1 ppb, the following will be done promptly:

1. The entire system shut down while the lead carbon unit is taken out of service and the carbon in it replaced. The exhausted carbon will be containerized, manifested, and transported for appropriate disposal or regeneration, in accordance with federal, state, and local regulations.

2. The system valving will be set so that the previous lead carbon vessel is the second carbon unit and the second carbon unit will be switched to the lead position.

If it is established through the monitoring program that a treatment system is operating efficiently to meet the discharge limit, then a request to reduce the sampling frequency may be made to US EPA. The sampling frequency may also be modified for other reasons following approval by US EPA. Any of the above requirements may be modified pursuant to the V.D.9 of the Consent Decree.

4.3 Recovery Well and Water Treatment System Maintenance

The extraction pumps will be inspected annually to insure that the high and low set points are operable and that each pump is in running condition. Repairs will be made if the pump or the set points are not operable. Start-up testing to initiate pumping will constitute such inspection if an extraction well is to be used during that year.

If pumping a well does not reduce the water level in the containment cell or other evidence of well fouling is apparent, the pump will be removed and the well screen cleaned with a solution formulated to remove inorganic and/or bacterial deposits (such as hydrogen peroxide, acid, or another oxidizer). In addition, chlorine may be injected periodically into the extraction wells if desired to inhibit bacterial growth. Water removed following such extraction well maintenance will be processed through the treatment systems.

During operation, the treatment systems will be inspected periodically to evaluate whether the systems are operating within recommended specifications. Maintenance and repair of the systems' components will be completed in accordance with the equipment operation manual and the manufacturer's recommendations. The on-going operation and maintenance of the treatment systems equipment includes but is not limited to:

- Monitoring the flow rates and pressure gauge readings.
- Inspecting and changing the sediment filters as needed.
- Visual inspection of the system components for wear, damage, and integrity.
- Reversing the flow direction through individual carbon beds for short periods to prevent channeling or hardening of the carbon ("Back-fluffing").
- Adding chlorine to the water stream to inhibit bacterial growth within the treatment systems.
- Chlorinating the recovery well casings to prevent encrustation of the well screens, pumps, or piping with iron precipitates or bacterial growth.

When chlorination procedures are conducted, the effluent water will be monitored for total residual chlorine using a portable meter. The amount of chlorine will be controlled so that the effluent meets 0.05 mg/l limit for total residual chlorine in accordance with the Illinois General Use Water Quality Standards (IAC 302.208). The results will be recorded in the treatment plant monitoring logs.

If a treatment system is shut down for more than thirty (30) days, the treatment system will be hydraulically tested before start-up with water pumped from the containment cells. The test will consist of pumping water through the treatment system at the same pumping rate as occurs during dewatering and monitoring for leaks for at least one hour. The pressure drops through the system will be assessed to determine if the treatment equipment is ready for water treatment. If leaks are detected, repairs will be scheduled as soon as practicable and the system will not be put into continuous operation until the repairs are made.

5.0 REPORTING

Monitoring results from the groundwater monitoring wells and the extraction well treatment system were submitted to the US EPA quarterly for at least the first two years and will be submitted in accordance with the sampling frequency in Section 3. 2 (semiannually thereafter, unless annual sampling is approved for any containment cell in accordance with the procedure in Section 3.2 paragraph 4). Groundwater monitoring test results will be submitted to US EPA in the next quarterly report after sampling and data validation review (in accordance with the QAPP). The quarterly report schedule was adjusted during 1996 so that the reports fall within approximately 45 days of receipt of the analytical data for the semiannual sampling events.

The results of cover inspections, extraction well maintenance, and treatment system maintenance will be included with the quarterly reports on a yearly basis. Information on the operation of the water treatment systems will be included in the quarterly reports for those periods during which water extraction and treatment occurs.

TABLES

TABLE 1

CONTAINMENT CELL COVER COMPOSITIONS

Containment Cell	Bituminous Concrete Acres	Vegetation Acres	Total Area Acres
Slip No. 3	0.2	1.3	1.5
West	1.0	2.4	3.4
East	0.6	4.9	5.5
	1.8	8.6	10.4

Note: All surface area values are approximate.

TABLE 2

GROUNDWATER MONITORING WELL
BACKGROUND SAMPLING RESULTS

	SLIP NO. 3 CONTAINMENT CELL				EAST CONTAINMENT CELL				WEST CONTAINMENT CELL			
Quarter	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10	W-11	W-12
3rd 1992	<1.0	1.4	<1.0	<1.0	3.1	4.2	<1.0	<1.0	2.0	39.0	1.7	<1.0
4th 1992	<1.0	1.4	3.4	<1.0	3.0	4.2	<1.0	<1.0	<1.0	17.0	1.9	<1.0
1st 1993	1.8	1.2	1.5	<1.0	11.0	<1.0	1.0	1.0	<1.0	14.0	2.4	3.1
2nd 1993	3.9	<1.0	<1.0	5.2	8.0	<1.0	1.0	1.0	<1.0	4.4	<1.0	<1.0
Background Average	1.9	1.3	1.7	2.1	6.3	2.6	1.0	1.0	1.3	19.0	1.8	2.0

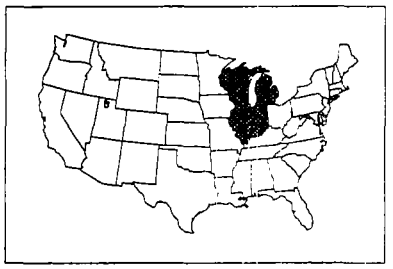
NOTES:

1. All results reported in ug/l (ppb).

2. When the result is reported as below a detection level (e.g., <1.0), the reported detection limit is used to calculate the background average.

FIGURES

DRAWING NUMBER 87-126-A566



SITE LOCATION MAP
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY	DATE: 5-14-96 SCALE: N.T.S.	FIGURE 1	DRAWING NUMBER 87-126-A566
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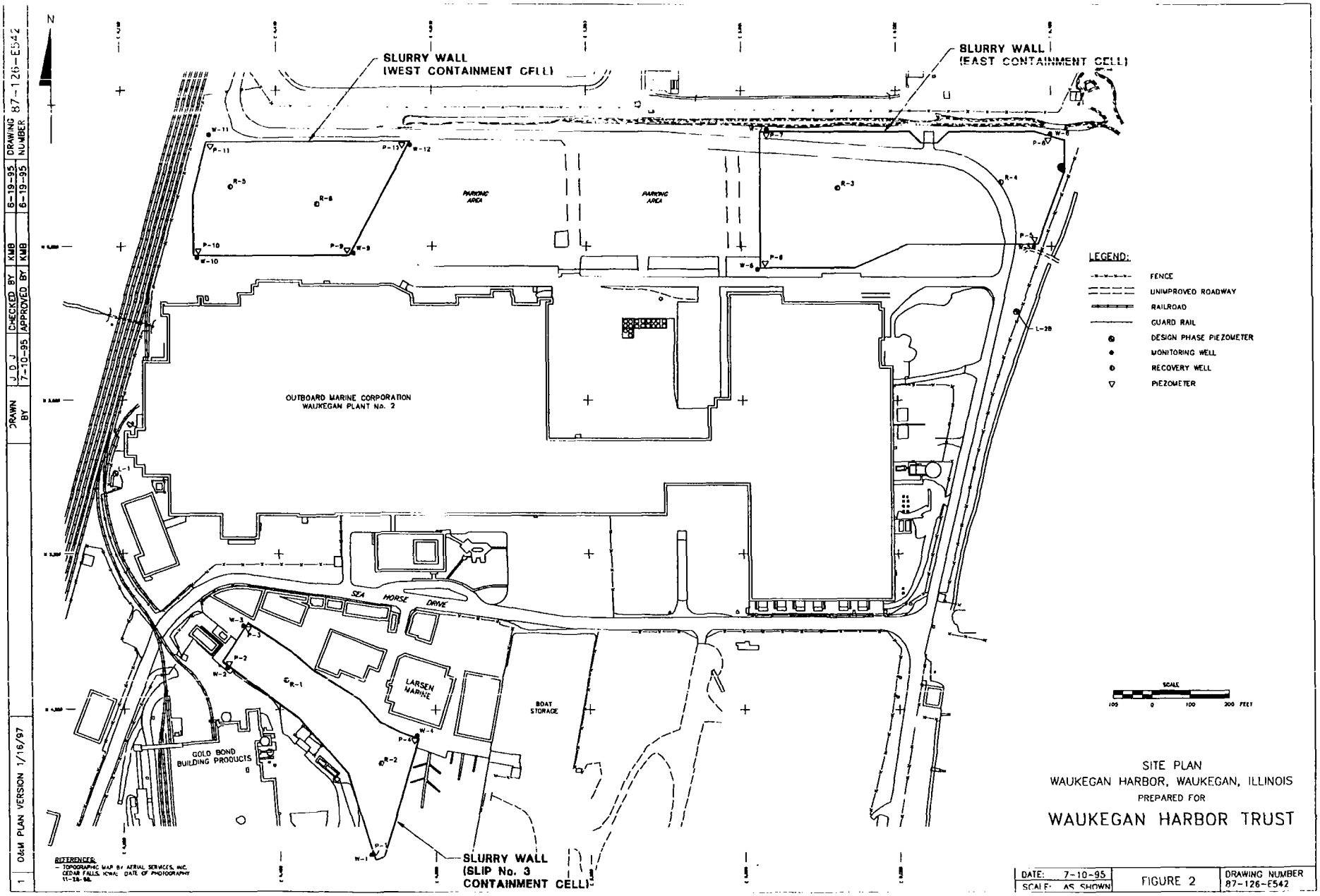
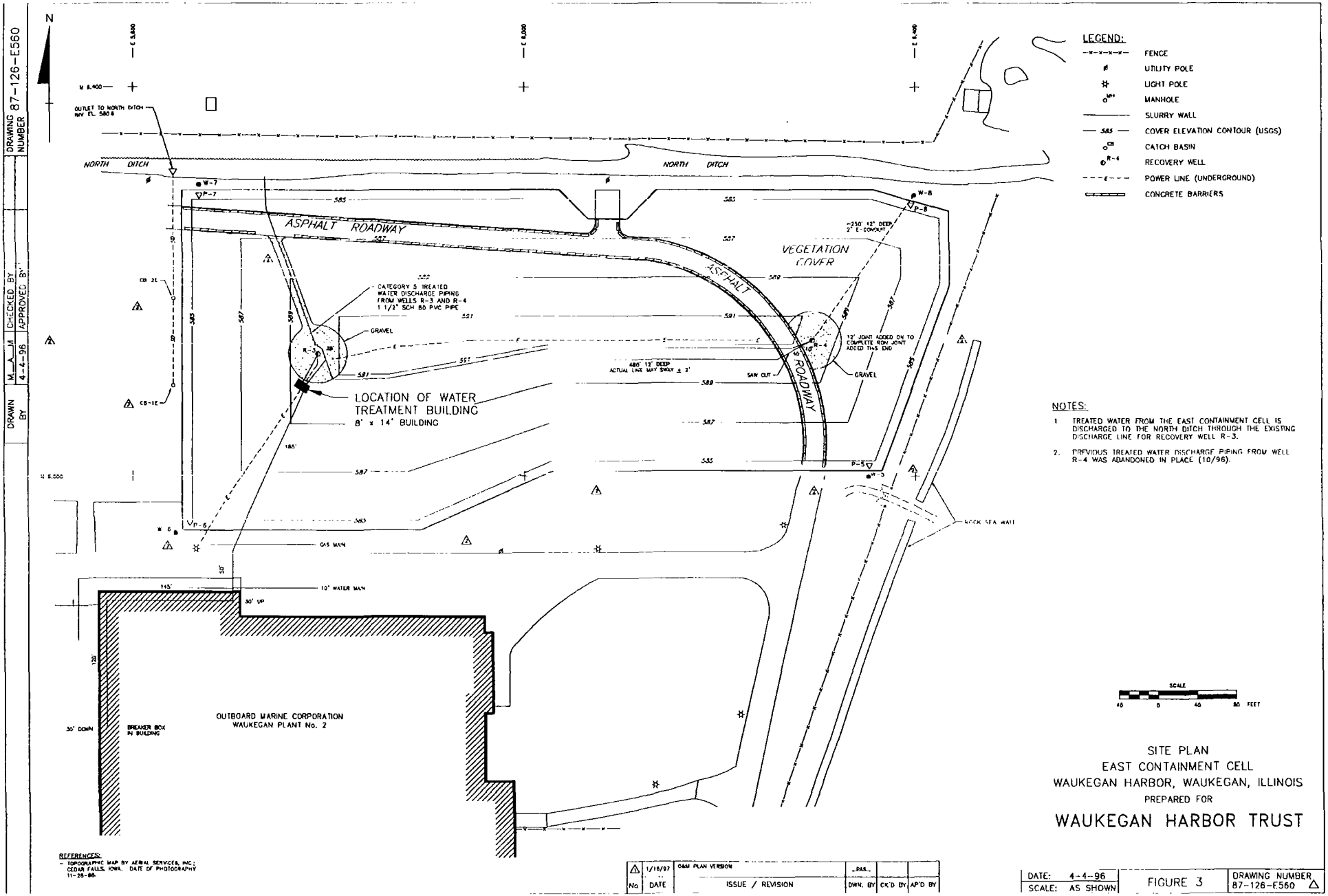


SITE PLAN
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST

DATE: 7-10-95	FIGURE 2	DRAWING NUMBER 87-126-E542
SCALE: AS SHOWN		

1	O&M PLAN VERSION 1/16/97					
		DRAWN BY	J.D.J	CHECKED BY	KMB	6-19-95
			7-10-95	APPROVED BY	KMB	6-19-95

DRAWING NUMBER 87-126-E542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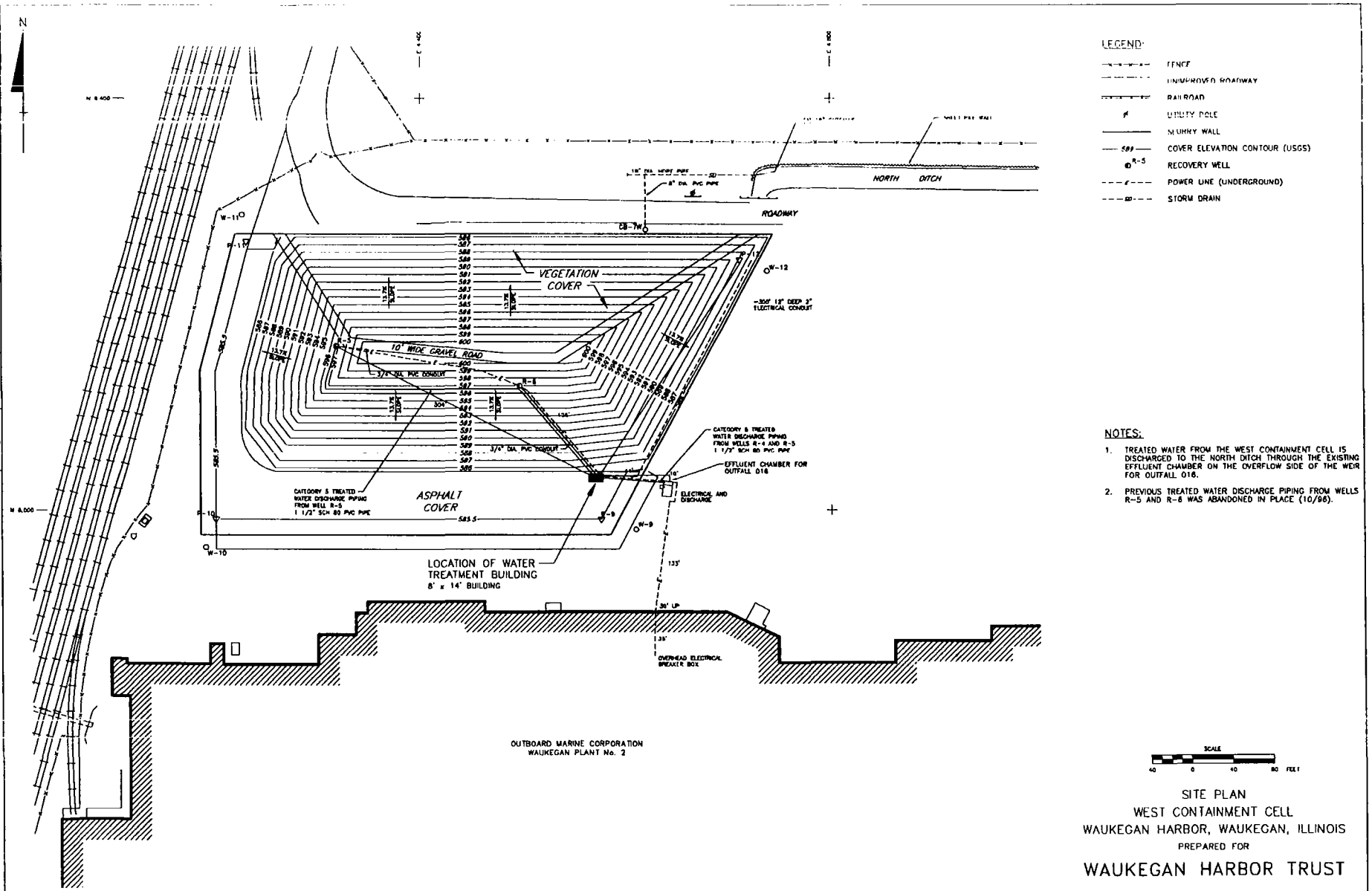
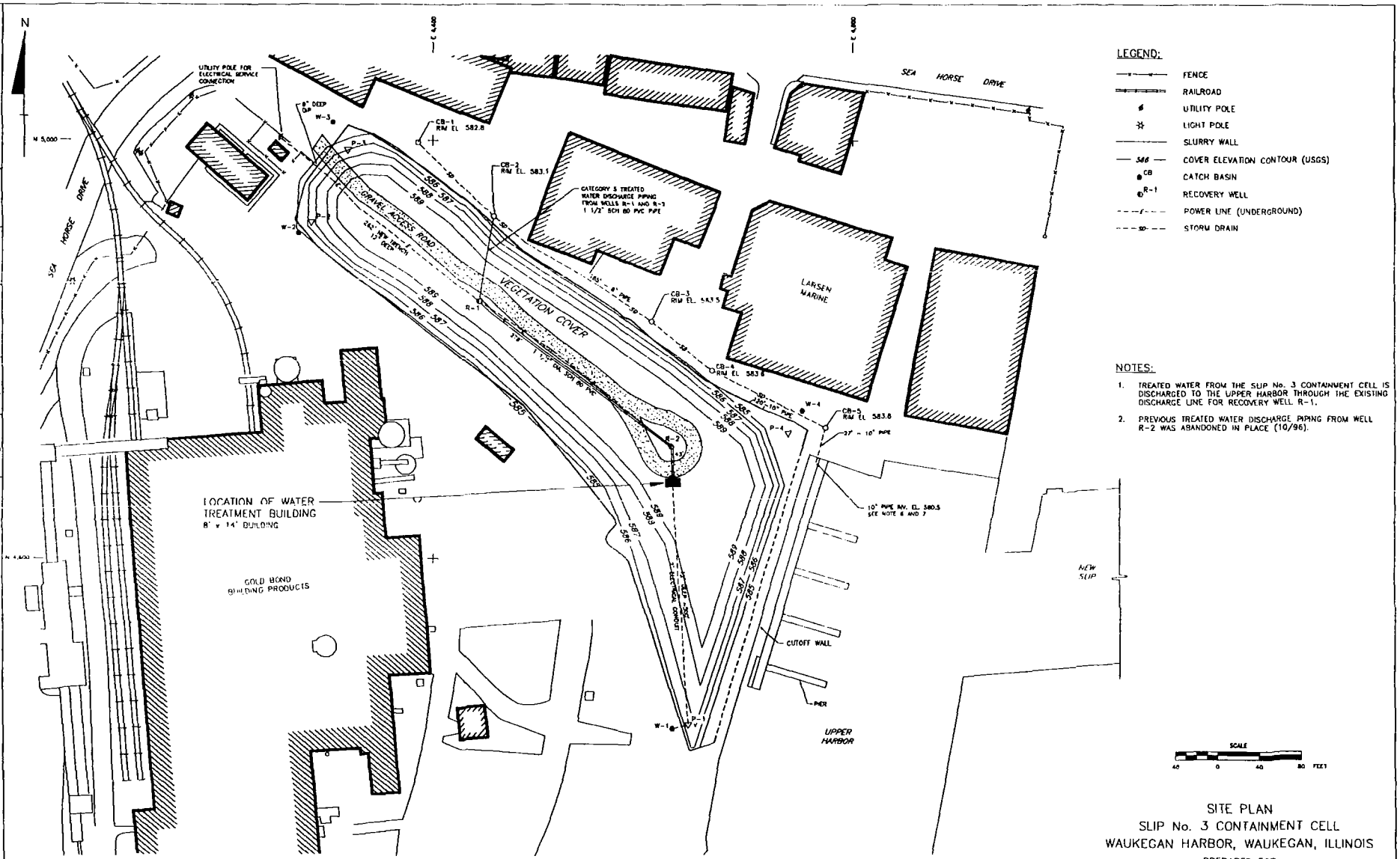
DRAWN BY
M A M 4-4-96
CHECKED BY
APPROVED BY
N
E 5,800
E 6,000
E 6,400
N 8,400
N 8,000
OUTLET TO NORTH DITCH INV EL. 580.8
NORTH DITCH
NORTH DITCH
W-7
P-7
W-8
P-8
585
587
ASPHALT ROADWAY
ASPHALT ROADWAY
VEGETATION COVER
~250' 12" DEEP 2" E-CONDUIT
CB 2E
CB-1E
CATEGORY S TREATED WATER DISCHARGE PIPING FROM WELLS R-3 AND R-4 1 1/2" SCH 80 PVC PIPE
GRAVEL
R-3
R-4
12" JOINT ADDED ON TO COMPLETE ROW JOINT ADDED THIS END
480' 12" DEEP ACTUAL LINE MAY SWAY ± 3'
SAW CUT
GRAVEL
LOCATION OF WATER TREATMENT BUILDING
8' x 14' BUILDING
589
591
P-5
W-5
P-6
W-6
GAS MAIN
BREAK SEA WALL
10" WATER MAIN
30' UP
30' DOWN
BREAKER BOX IN BUILDING
OUTBOARD MARINE CORPORATION
WAUKEGAN PLANT No. 2
LEGEND:
FENCE
UTILITY POLE
LIGHT POLE
MANHOLE
SLURRY WALL
585 COVER ELEVATION CONTOUR (USGS)
CATCH BASIN
R-4 RECOVERY WELL
POWER LINE (UNDERGROUND)
CONCRETE BARRIERS
NOTES:
1. TREATED WATER FROM THE EAST CONTAINMENT CELL IS DISCHARGED TO THE NORTH DITCH THROUGH THE EXISTING DISCHARGE LINE FOR RECOVERY WELL R-3.
2. PREVIOUS TREATED WATER DISCHARGE PIPING FROM WELL R-4 WAS ABANDONED IN PLACE (10/96).
SCALE
40 0 40 80 FEET
REFERENCES:
- TOPOGRAPHIC MAP BY AERIAL SERVICES, INC.; CEDAR FALLS, IOWA. DATE OF PHOTOGRAPHY 11-26-86.
SITE PLAN
EAST CONTAINMENT CELL
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST
No. DATE ISSUE / REVISION DWN. BY CK'D BY AP'D BY
1 1/16/97 O&M PLAN VERSION -DAS-
DATE: 4-4-96
SCALE: AS SHOWN
FIGURE 3
DRAWING NUMBER 87-126-E560 1



SITE PLAN
WEST CONTAINMENT CELL
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST

No.	DATE	ISSUE / REVISION	DWN BY	CK'D BY	AP'D BY
1	1/16/97	DRN PLAN VERSION	E.A.S.		

DATE: 4-5-96	FIGURE 4	DRAWING NUMBER 87-126-E561
SCALE: AS SHOWN		



DRAWING NUMBER 87-126-E559

DRAWN BY | M_A_M | 4-3-96

CHECKED BY | APPROVED BY

REFERENCES:
- TOPOGRAPHIC MAP BY AERIAL SERVICES, INC.; CEDAR FALLS, IOWA; DATE OF PHOTOGRAPHY 11-28-86.

SITE PLAN
SLIP No. 3 CONTAINMENT CELL
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST

No.	DATE	CONSTRUCTION ISSUE / REVISION	DWN BY	CK'D BY	AP'D BY
1	1/16/97	DRW PLAN VERSION	R.A.S.		

DATE: 4-3-96	FIGURE 5	DRAWING NUMBER 87-126-E559 △
SCALE: AS SHOWN		

A

APPENDIX B

HEALTH AND SAFETY PLAN FOR OPERATIONS AND MAINTENANCE

APPENDIX B

HEALTH AND SAFETY PLAN FOR OPERATIONS AND MAINTENANCE

(To Be Provided Separately)

APPENDIX C

OPERATION MANUAL
400 LB. LIQUID PHASE TREATMENT SYSTEM

OPERATION MANUAL

400 LB LIQUID PHASE TREATMENT SYSTEM

FOR

SMITH ENVIRONMENTAL

WAUKEGAN HARBOR REMEDIAL ACTION
(WAUKEGAN, ILLINOIS)

GREAT LAKES CARBON TREATMENT, INC.

3300 U.S. 131 N.E.
P.O. BOX 968
KALKASKA, MICHIGAN 49646
616 258-8014
FAX 616 258 6993

OPERATION MANUAL

400 LB LIQUID PHASE TREATMENT SYSTEM

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2 INTRODUCTION

THIS MANUAL COVERS A GENERAL DESCRIPTION OF OPERATION PROCEDURES FOR A GREAT LAKES CARBON TREATMENT DUAL TANK LIQUID PHASE TREATMENT SYSTEM, WITH PVC PIPE AND HOSE CONNECTIONS.

DETAILED INSTRUCTIONS FOR OPERATING AND MAINTAINING THE EQUIPMENT AND INSTRUMENTS ARE CONTAINED IN THE RESPECTIVE MANUFACTURER'S LITERATURE.

3 DESCRIPTION OF FACILITIES

3.1) GENERAL DESCRIPTION - DUAL TANK SYSTEM

THE EQUIPEMENT PROVIDED, FOR THE LIQUID TREATMENT SYSTEM CONSISTS OF (2) SUBMERSIBLE PUMPS, (1) FLO-ET FLOW CONTROL, (2) FLOW METERS, (1) ROSEDALE FILTER, (1) HOLDING TANK, (1) TRANSFER PUMP, (2) PRESSURIZED TANKS WITH UNDERDRAINS, (7) SAMPLE PORTS, (3) PRESSURE GAUGES AND CAMLOCK CONNECTIONS WITH PETROLEUM RATED HOSES, (1) VACUUM BREAKER LOOP, (1) 9 VALVE HEADER SYSTEM, (1) TREATMENT BUILDING CHLORINATOR AND (2) RECOVERY WELL CHLORINATORS.

3.2) PROCESS DESCRIPTION

THIS PROCESS DESCRIPTION IS A GENERAL DESCRIPTION OF THE OPERATION OF THE GRANULAR ACTIVATED LIQUID PHASE CARBON TREATMENT SYSTEM.

WATER FROM THE RECOVERY WELL(S) IS PUMPED OUT OF THE GROUND BY (2) SUBMERSIBLE EXTRACTION PUMPS, THROUGH A FLO-ET FLOW CONTROL (WHICH WILL MAINTAIN A MAXIMUM FLOW OF 15 GPM) THROUGH A TOTALIZING METER THROUGH A ROSEDALE FILTER, THEN INTO THE CARBON VESSELS, WHICH ARE CONNECTED IN SERIES AND IN A DOWNFLOW MODE.

THE FLOW TO THIS GREAT LAKES CARBON (GLC) TREATMENT SYSTEM IS CONTROLLED AT A MAXIMUM FLOW RATE OF 15 GPM, DUE TO THE FLO-ET FLOW CONTROL.

EACH TANK IS FILLED WITH 400 POUNDS OF GRANULAR ACTIVATED LIQUID PHASE CARBON. WATER ENTERS THE TOP OF THE FIRST TANK FLOWS THROUGH THE CARBON BED TO THE BOTTOM, BACK TO THE TOP OF THE SECOND TANK AND FLOWS DOWN THROUGH THE CARBON BED. THE TREATED WATER LEAVING THE SECOND TANK IS THEN DISCHARGED.

3.2) PROCESS DESCRIPTION "CONTINUED"

WHEN THE FIRST TANK BECOMES SATURATED WITH IMPURITIES ADSORBED FROM THE CONTAMINATION, THIS TANK MUST BE TAKEN OUT OF SERVICE AND THE CARBON REPLACED. THE SPENT CARBON IS TRANSFERRED FROM THE TANK TO DOT APPROVED SHIPPING CONTAINERS THROUGH A VACUUM SYSTEM. AFTER A CHANGE-OUT OCCURS, THE SECOND TANK BECOMES THE LEAD ADSORBER AND THE FIRST TANK BECOMES THE POLISH TANK. THIS PLACES THE FRESHEST CARBON IN SERVICE AS A POLISH FOR THE MOST COMPLETELY TREATED LIQUIDS. WHEN THE NEXT ADSORBER IS READY FOR CARBON REPLACEMENT, THE PROCEDURE IS REVERSED. THIS ALTERNATION OF ONE TANK AND THEN THE OTHER OCCURS EACH TIME RECHARGING OCCURS.

THE 150 GALLON HOLDING TANK ALLOWS FOR TREATMENT OF WATER THAT HAS BEEN COLLECTED (OTHER THAN FROM THE INFLUENT WELLS, FOR EXAMPLE FROM SPILLS, LEAKS, SAMPLE COLLECTION OR CLEANING OF THE SYSTEM). WATER WILL BE HELD IN THE HOLDING TANK UNTIL IT BECOMES NECESSARY TO TRANSFER THE LIQUID, BY MEANS OF THE TRANSFER PUMP THROUGH THE CARBON VESSELS. THIS HOLDING TANK CAN ALSO BE USED TO HOLD CLEAN WATER FOR PRESSURE TESTING OF THE LINES AND TO HYDRATE THE FRESH CARBON.

3.3) OPERATING DESCRIPTION

THE DESIGN OPERATING CONDITIONS FOR THE TANK SYSTEM ARE AS FOLLOWS:
- INFLUENT WATER FLOW (CONTINUOUS) - 15 GPM (MAXIMUM)
- INSTANTANEOUS RATE
- TEMPERATURE - LESS THAN 150 F
- NORMAL PRESSURE READING
  INLET TO LEAD TANK < 10 PSI
  INLET TO POLISH TANK < 10 PSI
  DISCHARGE FROM POLISH TANK < 10 PSI
- TANK CAPACITY - 400 POUNDS OF ACTIVATED CARBON
- LIQUID PHASE CARBON - HIGH PRESSURE FIBERGLASS < 120 PSI

DIMENSIONS	VOLUME	FLOW RATE
24" DIA. x 72"	120 GALLONS	15 GPM

3.3.1 UTILITY REQUIREMENTS

1. AIR (VACUUM OR PRESSURE)
   a) CARBON TRANSFER TO TANKS
   b) SPENT CARBON TRANSFER
   c) CARBON BED FLUIDIZATION (BACKFLUFFING)

2. ELECTRICAL
   a) PUMP(S)
   b) ELECTRICAL EQUIPMENT
   c) SHUTDOWNS

4 START-UP

4.1) PRELIMINARY STEPS

CHECK ALL VESSELS AND CONNECTIONS FOR LEAK TIGHTNESS. ALSO, HYDROSTATIC PRESSURE-TEST THE PRESSURE VESSELS. TO CHECK FOR LEAKS AND PRESSURE-TEST THE VESSELS, THE SYSTEM SHOULD BE FILLED WITH FRESH WATER. TO ACCOMPLISH THIS, THE NUMBER 8 & 9 VALVES IN THE SYSTEM WOULD HAVE TO BE CLOSED, THEN THE SYSTEM MUST BE FILLED WITH WATER, (CARBON VESSELS, HOLDING TANK AND PIPING). WITH THE VALVES CLOSED AND THE SYSTEM FULL OF WATER, THE HOLDING TANK TRANSFER PUMP SHOULD BE TURNED ON AND PRESSURED UP TO 40 PSI, IF THERE ARE ANY LEAKS THEY WILL BE EVIDENT. (IN THIS SYSTEM YOU WILL NEED APPROXIMATELY 450 GALLONS OF FRESH WATER TO PERFORM THIS LEAK TEST.) IF YOU WANT TO PRESSURE TEST THE SYSTEM USING WATER FROM THE RECOVERY WELLS, CLOSE VALVES 8 & 9 ON THE HEADER, AND TURN THE RECOVERY WELL PUMPS ON, AND LET THE SYSTEM PRESSURE UP TILL THE HIGH PRESSURE SHUTDOWN, SHUTS DOWN THE SYSTEM. (IF THERE ARE ANY LEAKS THEY WILL SHOW UP BEFORE THE HIGH PRESSURE SHUTDOWN, SHUTS THE SYSTEM DOWN.

AFTER THE FOREGOING CHECK HAS BEEN MADE AND ALL POINTS ARE SATISFACTORY, THE ENTIRE SYSTEM MUST BE FLUSHED WITH CLEAN WATER AND ALL FLOW OBSTRUCTIONS, MUST BE ELIMINATED. DURING THIS CIRCULATION, AND FLUSHING PERIOD, ALL INSTRUMENTS SHALL BE CALIBRATED. AT THE CONCLUSION OF THE FLUSHING PERIOD, THE SYSTEM SHALL BE OPENED OR DRAINED, (IF YOU DO NOT WANT TO PROCESS THE SYSTEM FLUSHING WATER. IT WILL CONTAIN NO CONTAMINANTS, SO THERE WOULD BE NO PROBLEMS BY RUNNING IT THROUGH THE SYSTEM.) ALSO ALL TEMPORARY STRAINERS SHALL BE REMOVED, THIS SYSTEM DOES NOT HAVE TEMPORARY STRAINERS SO IT IS NOT APPLICABLE.

4.2) PLACING SYSTEM IN OPERATION

- 4.2.1 CARBON TANK SYSTEM START-UP

TO PUT THE TANK SYSTEM ON-STREAM, THE FEED TO THE TANKS IS PROVIDED BY THE EXTRACTION PUMP(S). THE PUMP(S) SELECTOR SWITCH SHOULD BE IN THE "HAND" POSITION AND THE PUMP(S) STARTED AND BROUGHT UP TO OPERATING CONDITION PRIOR TO PLACING THE TREATMENT FACILITY INTO OPERATION. WHEN THIS HAS BEEN ACCOMPLISHED, THE FLOW WILL BE CONTROLLED AT THE REQUIRED SETTINGS.

WITH THE WATER FLOWING THROUGH THE SYSTEM , THE AUTOMATIC CONTROL CAN BE STARTED BY TURNING THE PUMP(S) HAND/OFF/AUTO SWITCH FROM HAND TO AUTO.

- 4.2.2 DUAL TANK SYSTEM

THE DUAL TANK SYSTEM CONSISTS OF TWO (2) PRESSURIZED FIBERGLASS TANKS CONNECTED IN A DOWNFLOW SERIES OPERATION. THE TANKS ARE RATED AT 120 PSI SERVICE, ALL EXTERNAL CONNECTIONS ARE HOSE AND CAMLOCK TYPE. THE FLOW IS DIRECTED BY THE VALVING AND HOSE/CAMLOCK CONNECTIONS WHICH SEQUENCES THE LEAD AND POLISH TANKS. SAMPLE PORTS ARE PROVIDED FOR INFLUENT, MIDFLUENT AND EFFLUENT READINGS.

4.3 START-UP AFTER A SHUTDOWN

AFTER A SHUTDOWN HAS OCCURRED AS A RESULT OF EITHER A HIGH PRESSURE OR HIGH LEVEL FLOOR SUMP, THE CAUSE MUST BE REMOVED, AND THE SYSTEM RESTARTED.

START-UP OF THE SYSTEM AFTER A HIGH PRESSURE, OR HIGH LEVEL FLOOR SUMP SHUTDOWN REQUIRES, 1) THE CAUSE OF THE SHUTDOWN MUST BE REMOVED, AND 2) AFTER PUSHING THE RESET BUTTON THE RECOVERY WELL PUMP CONTROL SWITCH SEQUENCED INTO THE RIGHT ORDER TO GET THE SYSTEM UP AND RUNNING IN THE AUTOMATIC MODE.

IN THE CASE OF A HIGH LEVEL FLOOR SUMP SHUTDOWN, LOCATING THE SOURCE OF THE EXCESS WATER AND FIXING IT WOULD BE YOUR FIRST CONCERN. SECONDLY YOU WOULD WANT TO DRAIN THE EXCESS WATER BACK INTO THE CONTAINMENT CELL BY OPENING THE 1" DIA. GATE VALVE IN THE SUMP PAN.

TO GET THE SYSTEM BACK UP AND RUNNING, YOU WILL BE REQUIRED TO SET THE RECOVERY WELL PUMP(S) SELECTOR SWITCH INTO THE HAND POSITION TO MANUALLY START THE RECOVERY WELL PUMP(S). UPON REACHING OPERATING CONDITIONS, SWITCH THE PUMP(S) SELECTOR SWITCH BACK TO AUTO, AND THE SYSTEM IS BACK UP AND RUNNING.

IN THE CASE OF A HIGH PRESSURE SHUTDOWN, THE CAUSE AGAIN MUST BE REMEDIED, - POSSIBLE CAUSES 1) CLOGGED ROSEDALE FILTER, 2) PLUGGING OF THE CARBON VESSESLS, OR 3) OBSTRUCTION IN A LINE. FOR CLOGGED ROSEDALE FILTER SEE SYSTEM MAINTENANCE SECTION 8.6 BAG FILTER CHANGE-OUT". FOR PLUGGING OF CARBON VESSELS SEE SYSTEM MAINTENANCE SECTION 8.1 "CARBON BED FLUIDIZATION (BACKFLUFFING)". IN THE CASE OF AN OBSTRUCTION IN THE LINE, THE OBSTRUCTION WOULD HAVE TO BE LOCATED, THEN REMOVED. ONCE THE SHUTDOWN HAS BEEN REMEDIED, SET THE RECOVERY WELL PUMP(S) SELECTOR SWITCH TO HAND AND START THE RECOVERY WELL PUMP(S). UPON REACHING OPERATING CONDITIONS, SWITCH THE PUMP(S) SELECTOR SWITCH BACK TO AUTO, AND THE SYSTEM IS BACK UP AND RUNNING.

START-UPS "CONTINUED"

START-UPS AFTER A SHORT TERM SHUTDOWN AS A RESULT OF ROUTINE MAINTENANCE: START-UP WOULD REQUIRE THE RECOVERY WELL PUMP(S) SELECTOR SWITCH BE SET IN THE HAND POSITION TO MANUALLY START THE RECOVERY PUMPS. ONCE UP TO OPERATING CONDITIONS, THE PUMP SELECTOR SWITCH CAN BE SWITCHED BACK TO THE AUTO POSITION AND THE SYSTEM IS RUNNING UNDER AUTOMATIC CONTROL.

START-UP AFTER A LONG TERM SHUTDOWN, ASSUMING THE CARBON VESSELS WERE LEFT FULL OF WATER, (AND THE HEATER IN THE BUILDING LEFT ON - DURING COLD WEATHER TO PREVENT FREEZING): THE SYSTEM SHOULD BE HYDROSTATICALLY PRESSURE TESTED FOR ANY SIGNS OF LEAKS IN THE SYSTEM (SEE SECTION 4.1). LEAVING VALVES 8 & 9 CLOSED, THE PIPING UP TO THE CARBON VESSELS SHOULD BE FILLED WITH WATER AND PRESSURE APPLIED. IF ANY LEAKS ARE EVIDENT, THEY NEED TO BE FIXED. TO PUT THE SYSTEM BACK ON-STREAM, THE FEED TO THE TANKS IS PROVIDED BY THE EXTRACTION PUMP(S). THE PUMP(S) SELECTOR SWITCH SHOULD BE IN THE "HAND" POSITION AND THE PUMP(S) STARTED AND BROUGHT UP TO OPERATING CONDITION. ONCE UP TO OPERATING CONDITION, THE PUMP SELECTOR SWITCH CAN BE SWITCHED BACK TO THE AUTO POSITION AND THE SYSTEM IS RUNNING UNDER AUTOMATIC CONTROL.

5 TANK SEQUENCING

5.1) DESCRIPTION

THE TANKS ARE DESIGNED FOR DOWNFLOW OPERATION AND CAN BE OPERATED AS A SINGLE STAGE UNIT OR AS A TWO STAGE SYSTEM AS INDICATED BY THE FOLLOWING:

TANK "A" FIRST STAGE, TANK "B" POLISH STAGE
TANK "B" FIRST STAGE, TANK "A" POLISH STAGE

WHEN CARBON IN THE FIRST STAGE TANK BECOMES SPENT, THE SPENT CARBON IS REPLACED WITH FRESH CARBON. DURING THIS EXCHANGE, THE POLISH TANK THEN BECOMES THE FIRST STAGE TANK, WHILE THE NEWLY FILLED TANK BECOMES THE POLISH TANK, THIS ALTERNATING OF TANKS OCCURS EACH TIME SPENT CARBON IS EXCHANGED FOR FRESH CARBON. THIS COUNTER-CURRENT OPERATION PERMITS THE MAXIMUM USE OF CARBON BEFORE IT IS REPLACED, AND IT PROVIDES EXCESS CARBON ON-STREAM FOR EXTREME CIRCUMSTANCES.

5.1.1 TANK "A" FIRST STAGE, TANK "B" POLISH STAGE

SEE ILLUSTRATION #1

5.1.2 TANK "B" FIRST STAGE, TANK "A" POLISH STAGE

SEE ILLUSTRATION #2

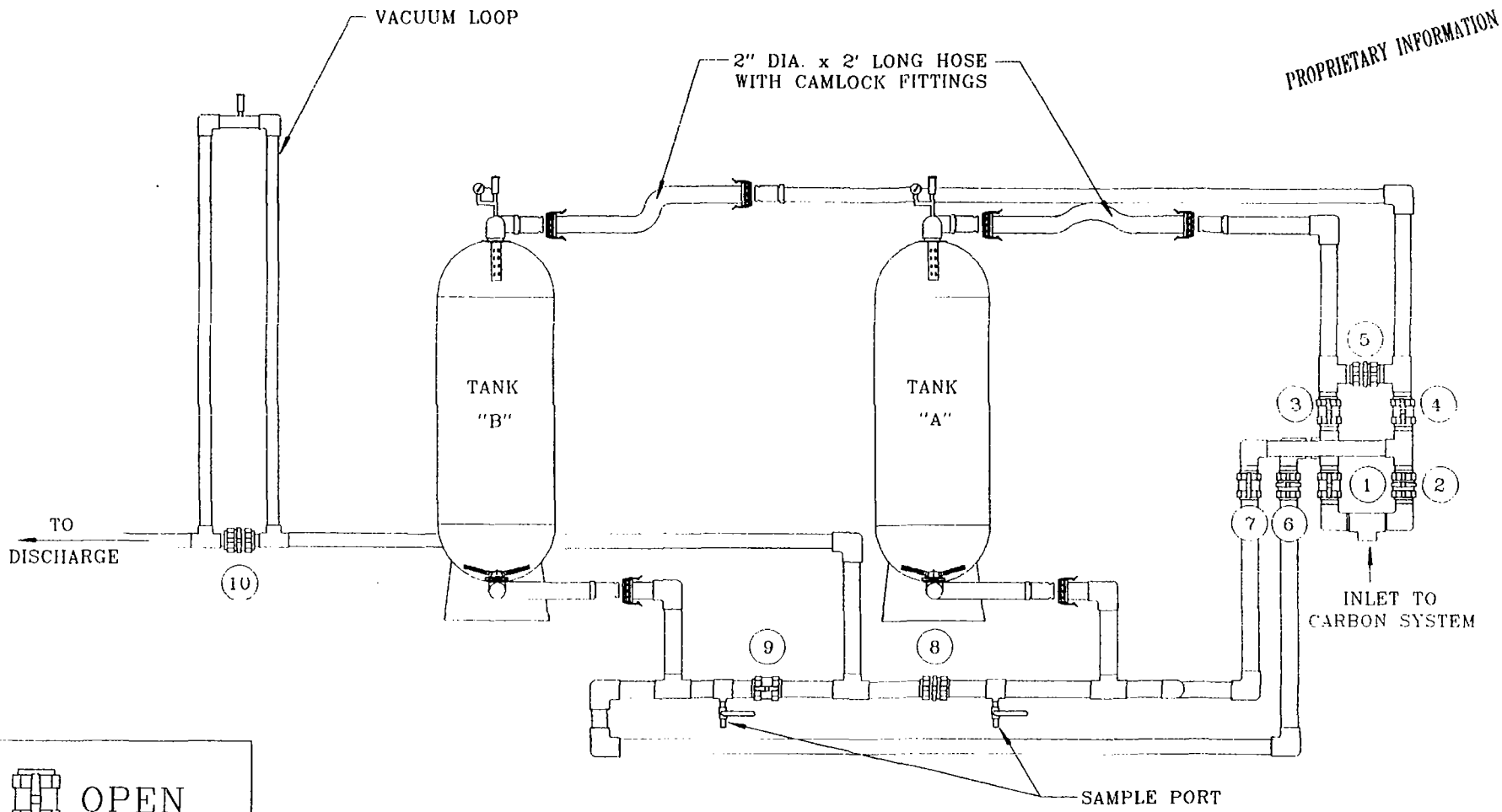


ILLUSTRATION #1

(VALVES SO TANK "A" IS THE TREATMENT TANK & TANK "B" IS THE POLISH TANK)

OPEN VALVES: 1,3,4,7,9
CLOSED VALVES: 2,5,6,8,10

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

VALVING FOR
TANK "A" TREATMENT
TANK "B" POLISH

SCALE: NONE	TOLERANCES: XX ±	DRAWN BY
DATE: 23 MARCH 94		S. KRELLWITZ
SHEET	ENGINEER	DR. NUMBER: PEWIAT

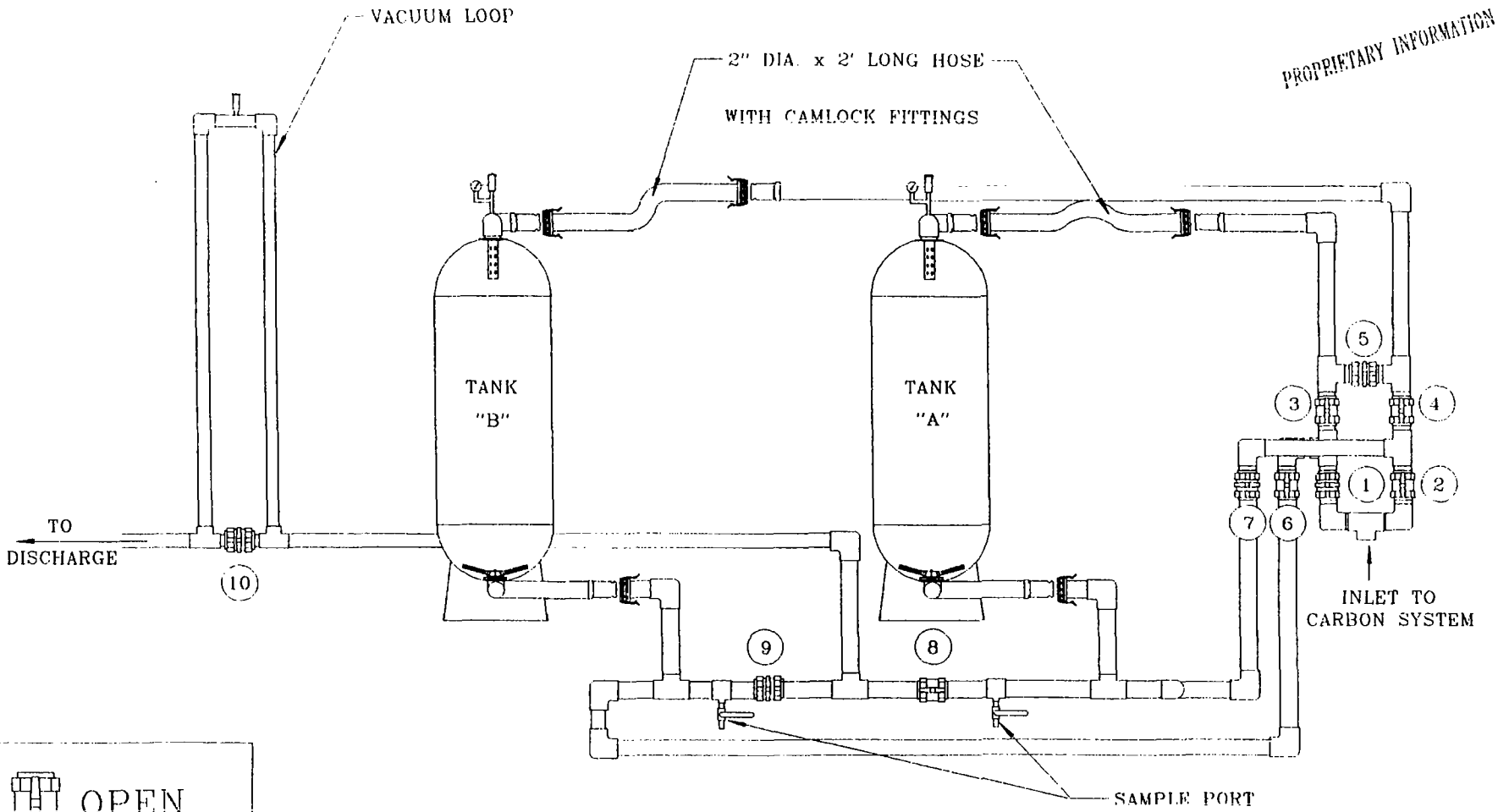


ILLUSTRATION #2

(VALVES SO TANK "B" IS THE TREATMENT TANK & TANK "A" IS THE POLISH TANK)

OPEN VALVES: 2,3,4,6,8

CLOSED VALVES: 1,5,7,9,10

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

VALVING FOR
TANK "B" TREATMENT
TANK"A" POLISH

SCALE: NONE	TOLERANCES XX	DRAWN BY:
DATE 03 MARCH 94		
CHART	ENGINEER	DR NUMBER

6 TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
PREMATURE BREAKTHROUGH	CHANGE OF INFLUENT CONCENTRATION	CONFIRM BY CHECKING EFFLUENT SAMPLES BEFORE CHANGING CARBON
SUBMERSIBLE PUMP NOT PUMPING WATER	A SYSTEM SHUTDOWN HAS BEEN ACTIVATED	CHECK FOR A "HIGH LEVEL FLOOR SUMP" SHUTDOWN, SEE SECTION 4.3 "START-UP AFTER A SHUTDOWN"
		CHECK FOR A "HIGH PRESSURE" SHUTDOWN SEE SECTION 4.3 START-UP AFTER A SHUTDOWN"
	LOSS OF POWER TO THE SUBMERSIBLE PUMP	CHECK FOR POWER TO THE BUILDING
		PUT PUMP SELECTOR SWITCH IN HAND TO VERIFY PUMP IS NOT PUMPING WATER. IF NOT NEED AN ELECTRICAN TO TROUBLESHOOT
	LEVEL PROBE OUT OF WATER	WAIT FOR WATER TABLE TO RECOVER OR PULL PUMP AND LOWER LEVEL PROBE
	WARRICK LEVEL CONTROL DEFECTIVE	NEED ELECTRICAN TO VERIFY IT IS DEFECTIVE AND REPLACE IF NEED BE
SYSTEM SHOWING HIGH PRESSURE	ROSEDALE FILTER PLUGGED UP	CHANGE FILTER BAG (SEE SECTION 8.4)
	CARBON BED(S) PLUGGING UP	FLUIDIZE THE CARBON BED(S) (SEE SECTION 8.1)
	CLOGGED PROCESS FLOW LINE	FIND AND REMOVE OBSTRUCTION

6 TROUBLESHOOTING "CONTINUED"

PROBLEM	PROBABLE CAUSE	REMEDY
CAN NOT EMPTY HOLDING TANK, TRANSFER PUMP NOT PUMPING	NO POWER TO PUMP	MAKE SURE THERE IS POWER TO CONTROL PANEL
	TRANSFER PUMP RATE VALVE CLOSED	OPEN RATE VALVE
FROZEN LINES, BROKEN VALVES	COLD WEATHER DURING A SHUTDOWN	DRAIN PIPING.INSULATE AND/OR HEAT TAPE PROCESS

7 GENERAL SYSTEM INFORMATION

7.1) CARBON WET OUT PERIOD

ON NEW SYSTEMS, IT IS RECOMMENDED THAT THE NEW CARBON IN THE VESSELS SOAK IN WATER FOR A MAXIMUM OF 24 HOURS BEFORE THE SYSTEM IS STARTED UP. THIS ALLOWS THE AIR IN THE CARBON PORES TO BE DISPLACED BY THE WATER, 8 HOURS WOULD BE THE MINUMUM ALLOWABLE TIME TO PRESOAK THE CARBON.

7.2) SHUTDOWNS

FOR SHUTDOWNS THE FEED PUMP(S) SHALL BE SHUT OFF, AND VALVES ON THE BOTTOM OF THE TANKS SHOULD BE SHUT OFF ALSO. CLOSING OF THE VALVES AT THE BOTTOM OF THE TANKS KEEPS THE CARBON IN THE TANKS WET DURING SHUTDOWN, IF THE CARBON HARDENS UP IT MAKES RESTART-UP SIGNIFICANTLY MORE DIFFICULT.

7.2.1) SHORT TERM SHUTDOWNS

FOR A SHORT TERM SHUTDOWN, PUT THE RECOVERY PUMP(S) SELECTOR SWITCH IN THE OFF POSITION TO STOP THE PROCESS FLOW. KEEP VALVES 8 & 9 CLOSED IF YOU WANT TO KEEP WATER IN THE CARBON VESSELS, IF NOT, OPEN VALVES 8,9 & 10 AND THE WHOLE SYSTEM WILL DRAIN. ONCE THE SYSTEM IS SHUTDOWN THE WORK THAT REQUIRED THE SHUTDOWN CAN BE PERFORMED. THEN TO RESTART THE SYSTEM, PUT THE RECOVERY PUMP(S) SELECTOR SWITCH IN THE HAND POSITION TO START THE PUMPS. ONCE THE SYSTEM GETS BACK UP TO OPERATING CONDITIONS, THE SELECTOR SWITCH CAN BE PUT IN THE AUTO MODE AND THE SYSTEM WILL BE BACK UP AND RUNNING.

7.2.2) LONG TERM SHUTDOWNS (WINTERIZATION)

PRIOR TO A LONG TERM SHUTDOWN, ONE MAY WANT TO CHLORINATE THE RECOVERY PUMP AND RECOVERY LINES. TO CHLORINATE WELL #1, TURN RECOVERY WELL #1 PUMP AND RECOVERY WELL #2 PUMP OFF AT THE CONTROL PANEL. OPEN THE CHLORINATOR WATER SUPPLY FROM THE BOTTOM OF THE HEADER, AND THEN OPEN WELL #1 CHLORINATOR VALVE, TURN RECOVERY WELL #2 PUMP ON TO CHLORINATE RECOVERY WELL #1. AFTER CHLORINATING RECOVERY WELL #1 CLOSE CHLORINATOR VALVE #1. TO CHLORINATE RECOVERY WELL #2, CLOSE DISCHARGE VALVES #8 & #9 OF THE HEADER AND LET SYSTEM PRESSURE UP TILL THE HIGH PRESSURE SHUT-DOEN SHUTS DOWN THE SYSTEM. AT THIS POINT OPEN CHLORINATOR #2 VALVE AND LET THE SYSTEM PRESSURE BLEED OFF THROUGH CHLORINATOR #2. (THIS WILL CAUSE THE 80 GALLONS OF WATER IN THE SYSTEM TO GO THROUGH THE CHLORINATOI AND CHLORINATE RECOVERY WELL #2.) AFTER YOU HAVE FINISHED CHLORINATING THE RECOVERY PUMP AND LINES, YOU SHOULD BLOW DOWN THE CHLORINE LINES FROM THE BUILDING TO THE WELLS TO REMOVE THE WATER FROM THE LINES. (AIR COMPRESSOR SHOULD BE USED).

GENERAL SYSTEM INFORMATION "CONTINUED"

7.2.2 LONG TERM SHUTDOWN CONTINUED

AFTER THE RECOVERY PUMPS AND LINES HAVE BEEN CHLORINATED, THERE ARE (2) TWO OPTIONS FOR LONG TERM SHUTDOWN OF THE TREATMENT SYSTEM: OPTION #1 IS THE REMOVAL OF ALL WATER FROM THE TREATMENT SYSTEM, INCLUDES THE RECOVERY LINES, LINES AND CARBON VESSELS IN THE TREATMENT BUILDING AND THE DISCHARGE LINE. OPTION #2 IS THE REMOVAL OF WATER FROM THE RECOVERY LINES AND THE DISCHARGE LINE, LEAVING THE CARBON VESSELS FULL OF WATER.

IN BOTH CASES, AT THE CONTROL PANEL YOU WILL HAVE TO PUT THE RECOVERY PUMP(S) SELECTOR SWITCH IN THE OFF POSITION TO STOP THE PROCESS FLOW.

IN OPTION #1, THE FIRST THING YOU DO AFTER STOPPING THE PROCESS FLOW IS TO ATTACH AN AIR COMPRESSOR LINE TO THE 1" RISER PIPE AT THE WELL HEAD. THE SECOND OPERATION WOULD BE TO REMOVE THE PLUG AND OPEN THE 1" BALL VALVE AT THE WELL HEAD, TURN AIR COMPRESSOR ON AND BLOW THE WATER BACK TO THE TO THE TREATMENT BUILDING UNTIL AIR EXITS THE EFFLUENT SAMPLE PORT ON THE POLISH VESSEL. (NOTE: ONCE AIR HAS REACHED THIS POINT, CLOSE THE SAMPLE PORT AND CONTINUE BLOWING DOWN THE DISCHARGE LINE FOR AN ADDITIONAL 10-15 MINUTES TO INSURE COMPLETE WATER REMOVAL FROM THE LINES. ONCE COMPLETE, CLOSE THE 1" BALL VALVE AND REINSTALL THE PLUG AT THE WELL HEAD. (THE RECOVERY LINES, TREATMENT BUILDING LINES/CARBON VESSELS, AND THE DISCHARGE LINE SHOULD BE FREE OF WATER.) THE THIRD THING TO DO, AFTER ALL THE WATER HAS BEEN REMOVED FROM THE SYSTEM, THE CARBON SHOULD BE REMOVED FROM THE FRP VESSELS AND PUT INTO 55 GALLON DRUMS AND STORED ON SITE UNTIL RESTART-UP.

IN OPTION #2 WE WANT TO LEAVE WATER IN THE CARBON VESSELS WHICH MAKE RESTART-UP EASIER. IF THE WATER IS DRAINED OUT OF THE VESSELS AND NOT REMOVED, THE CARBON WILL BECOME HARDENED MAKING RESTART-UP DIFFICULT. HARDENED CARBON WILL NOT ALLOW WATER TO FLOW UNIFORMLY THROUGH IT, THIS WILL LEAD TO CHANNELING OF THE WATER THROUGH THE CARBON. WHICH MEANS YOU WILL HAVE LARGE QUANITIES OF UNUSED CARBON EVEN THOUGH TEST INDICATE YOU HAVE BREAKTHROUGH ON THAT VESSEL. THE ACTUAL CHANGE-OUT OF THE CARBON VESSEL WILL BE MORE DIFFICULT, BECAUSE THE CARBON ACTUALLY HAS TO BE CHISELED INTO SMALLER PIECES BEFORE BEING REMOVED. IF THE VESSELS ARE LEFT FULL OF WATER DURING A LONG TERM SHUTDOWN, IT IS RECOMMENDED THAT THE BUILDING HEATER SHOULD BE SET AT A TEMPERATURE THAT WILL PREVENT FREEZING (40-45 DEGREES F).

IN OPTION #2, THE FIRST THING YOU DO AFTER STOPPING THE PROCESS FLOW IS TO ATTACH AN AIR COMPRESSOR LINE TO THE 1" RISER PIPE AT THE WELL HEAD. THE SECOND OPERATION WOULD BE TO REMOVE THE PLUG AND OPEN THE 1" BALL VALVE AT THE WELL HEAD, TURN AIR COMPRESSOR ON AND BLOW THE WATER BACK TO THE TO THE TREATMENT BUILDING UNTIL AIR EXITS THE INFLUENT SAMPLE PORT ON THE RECOVERY WELL METER RUN. AT THIS POINT ALL WATER IN THE INFLUENT LINE HAS BEEN REMOVED, THE INFLUENT SAMPLE PORT CAN BE CLOSED, THE AIR COMPRESSOR

GENERAL SYSTEM INFORMATION "CONTINUED"

7.2.2 LONG TERM SHUTDOWN CONTINUED

REMOVED AND THE 1" BALL VALVE CLOSED AT THE WELL HEAD AND REPLUGGED. (REPEAT THE ABOVE MENTIONED STEPS TO BLOW DOWN THE OTHER RECOVERY WELL. NOW THAT THE RECOVERY LINES ARE WATER FREE THE AIR COMPRESSOR MUST BE BROUGHT TO THE TREATMENT BUILDING AND ATTACHED TO THE VACUUM BREAKER LOOP AT THE AIR ELIMINATOR (THE AIR ELIMINATOR HAS TO BE REMOVED). WITH VALVES #8 &#9 CLOSED, AIR CAN BE APPLIED AND THE DISCHARGE LINE FROM THE TREATMENT BUILDING TO THE WELL HEAD WILL BE FREE OF WATER.

WITH THE WATER DRAINED OUT OF THE RECOVERY LINES AND THE BUILDING HEATED, THE SYSTEM WOULD BE READY FOR LONG TERM (WINTER) SHUTDOWN. AFTER A LONG TERM SHUTDOWN, START-UP PROCEDURES WOULD FOLLOW SECTION 4.3 "START-UP AFTER A SHUTDOWN".

7.3) EMERGENCY PROCEDURES

IN THE EVENT THAT SOMETHING SHOULD OCCUR TO CAUSE A SHUTDOWN OF A TANK, THE OPERATION SHALL BE STOPPED UNTIL THE SITUATION HAS BEEN REPAIRED.

7.4) SAFETY - SPECIAL NOTE

ALL CONFINED SPACES INCLUDING THOSE CONTAINING ACTIVATED CARBON SHOULD BE PRESUMED TO BE HAZARDOUS.

LOCK OUT/TAG OUT PROCEDURES ARE RECOMMENDED WHENEVER ANY WORK IS TO BE PERFORMED ON ANY PIECE OF EQUIPMENT, (WHETHER IT IS ELECTRICAL OR NONELECTRICAL). IF SOME SERVICE WORK IS REQUIRED, MAKE SURE YOU HAVE A QUALIFIED CONTRACTOR DOING THE SERVICE WORK.

8 SYSTEM MAINTENANCE

SEE MANUFACTURER'S LITERATURE FOR INDIVIDUAL ITEM MAINTENANCE. G.L.C. TANKS AND HOSE CONNECTIONS SHOULD BE MAINTENANCE FREE, IF MAINTENANCE IS REQUIRED, IT CAN BE PERFORMED DURING SITE VISITS OR DURING CHANGE OUTS.

8.1) CARBON BED FLUIDIZATION (BACKFLUFFING)

WHEN HIGH PRESSURE OCCURS DUE TO PACKING OF THE CARBON BED OR FINES FROM THE GROUNDWATER RESTRICT THE POROSITY OF THE CARBON, CARBON BED FLUIDIZATION MAY BE REQUIRED. CARBON BED FLUIDIZATION REQUIRES THAT EITHER AIR OR WATER BE APPLIED TO THE BOTTOM OF THE VESSEL TO LIFT THE CARBON BED AND LOOSEN THE RESTRICTION. (IF THIS DOES NOT LOOSEN THE RESTRICTION, YOU WOULD HAVE TO GO AND PHYSICALLY REMOVE THE TOP 3 OR 4 INCHES OF CARBON FROM THE CARBON VESSEL.)

IN SOME INSTANCES BACKFLUFFING A SYSTEM ONCE A WEEK WITH WATER WILL KEEP A SYSTEM FROM PRESSURING UP. BUT IN SOME CASES BACKFLUFFING WITH WATER ONCE A WEEK IS NOT OFTEN ENOUGH OR POSSIBLE POWERFUL ENOUGH TO BREAK UP THE RESTRICTION. IN THESE CASES AIR SHOULD NEXT BE TRIED TO BE USED TO BREAK UP THE RESTRICTION. AND IF WATER OR AIR FAILS TO REMOVE THE RESTRICTION THEN YOU WILL HAVE TO GO AND REMOVE THE TOP 3-4 INCHES OF CARBON FROM THE VESSEL. SO EACH SYSTEM HAS TO BE MONITORED TO SEE WHAT WILL WORK THE BEST IN BACKFLUFFING OF THAT SYSTEM.

IF YOU ARE BACKFLUFFING USING WATER, YOU WOULD ADJUST YOUR SYSTEM VALVING ACCORDING TO EITHER ILLUSTRATION #3 OR #4 DEPENDING ON WHICH VESSEL YOU ARE INTENDING TO BACKFLUFF.

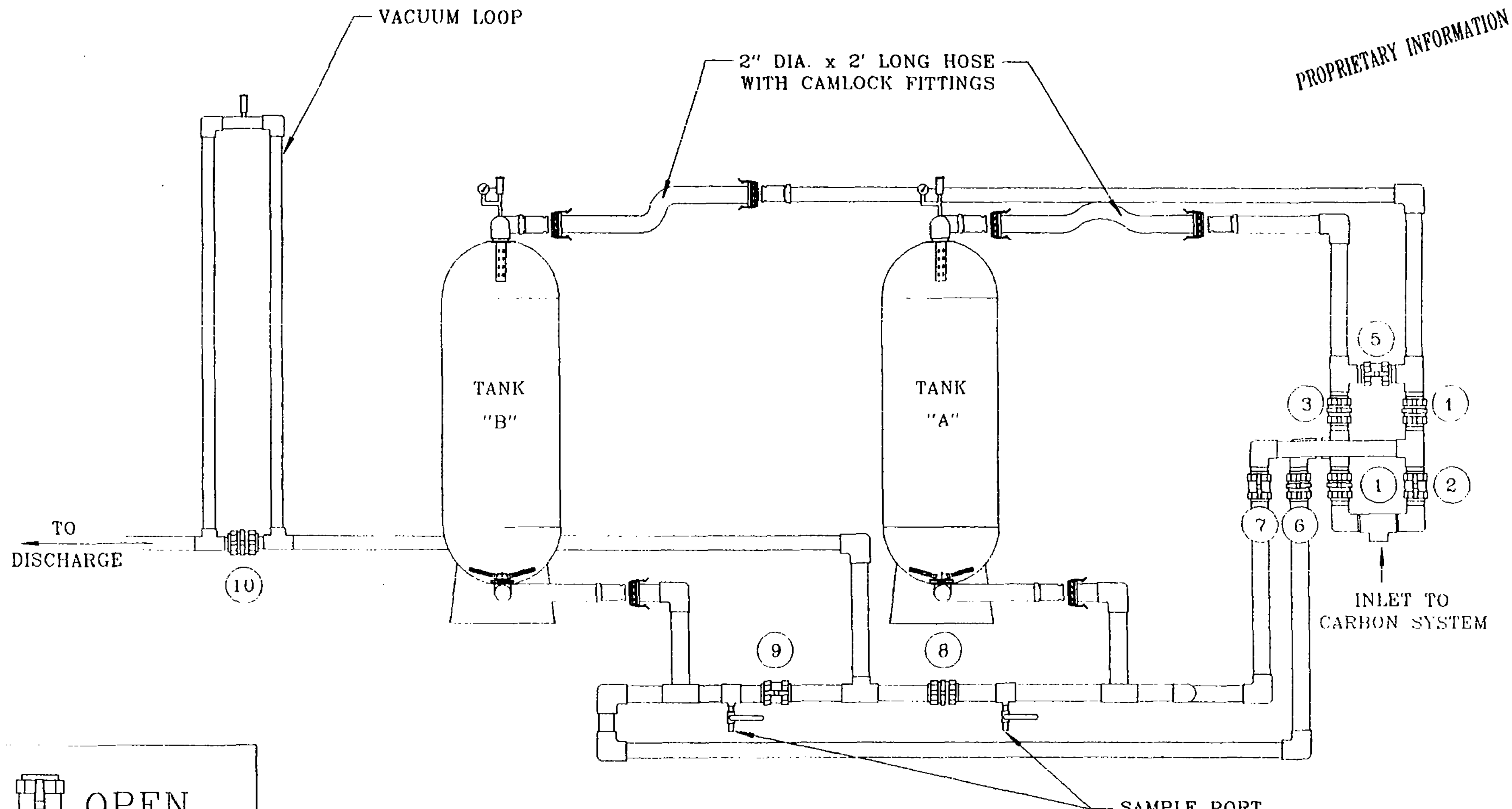
IF YOU ARE BACKFLUFFING USING AIR, YOU WOULD NEED TO ATTACH YOUR AIR SUPPLY TO THE CARBON CHANGE-OUT PORT (SEE DRAWING "8' x 14' STEEL BUILDING WITH (2) 400LBS VESSELS" FOR LOCATION). SET THE VALVING ACCORDING TO EITHER ILLUSTRATION #3 OR #4 DEPENDING ON WHICH VESSEL YOU ARE INTENDING TO BACKFLUFFING. TURN YOUR AIR SUPPLY ON AND BEGIN APPLYING PRESSURE TO THE SYSTEM, (IN REGULARLY MAINTAINED SYSTEMS, 10-12 PSI IS ENOUGH PRESSURE TO LOOSEN THE CARBON BED.) YOU SHOULD LEAVE THAT 10-12 PSI ON THE VESSEL FOR 10-15 MINUTES TO LET THE CARBON GET THOROUGHLY LOOSENED UP.

TO BACKFLUSH TANK "A" SEE ILLUSTRATION # 3

TO BACKFLUSH TANK "B" SEE ILLUSTRATION # 4

8.2) SHUTDOWNS

SEE "SHUTDOWNS" SECTION 7.2 OF GENERAL SYSTEM INFORMATION



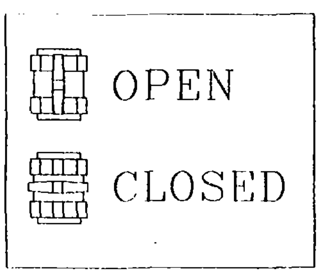


ILLUSTRATION #3

(VALVES SO TANK "A" CAN BE ISOLATED FOR BACKFLUSHING)

OPEN VALVES: 2,5,7,9

CLOSED VALVES: 1,3,4,6,8,10

NOTE:

THE DESIGN, SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION WHICH IS FOR THE SOLE, EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THIS INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER, SHAPE OR FORM WITHOUT THE WRITTEN CONSENT OF GREAT LAKES CARBON TREATMENT, INC

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

VALVING FOR
TANK "A"
BACKFLUSHING

SCALE: NONE	TOLERANCES	DRAWN BY
DATE 24 MARCH 94		[illegible]
SHEET	ENGINEER	DF NUMBER OPENTANF

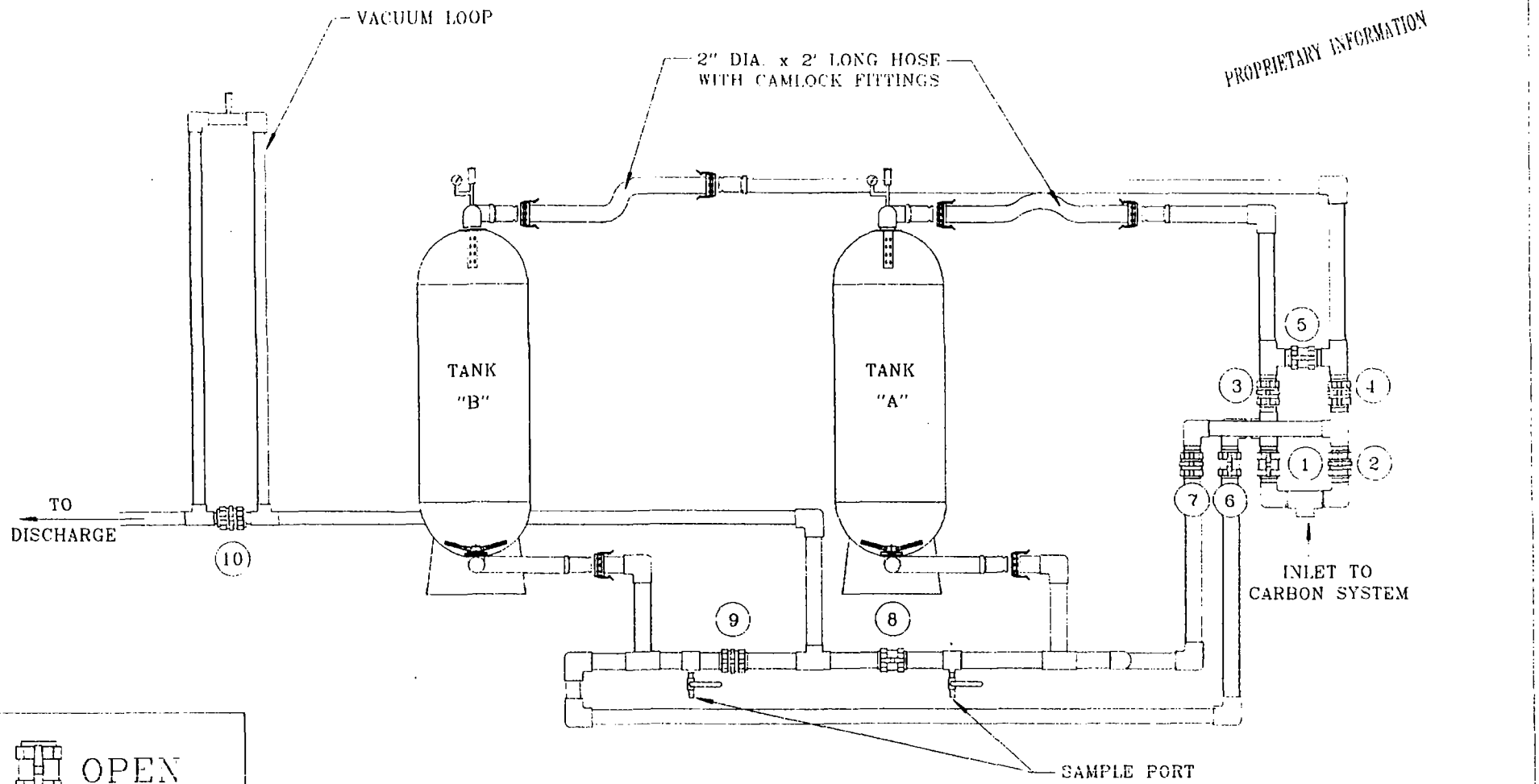


ILLUSTRATION #4

(VALVING SO TANK "B" CAN BE ISOLATED FOR BACKFLUSHING)

OPEN VALVES: 1,5,6,8

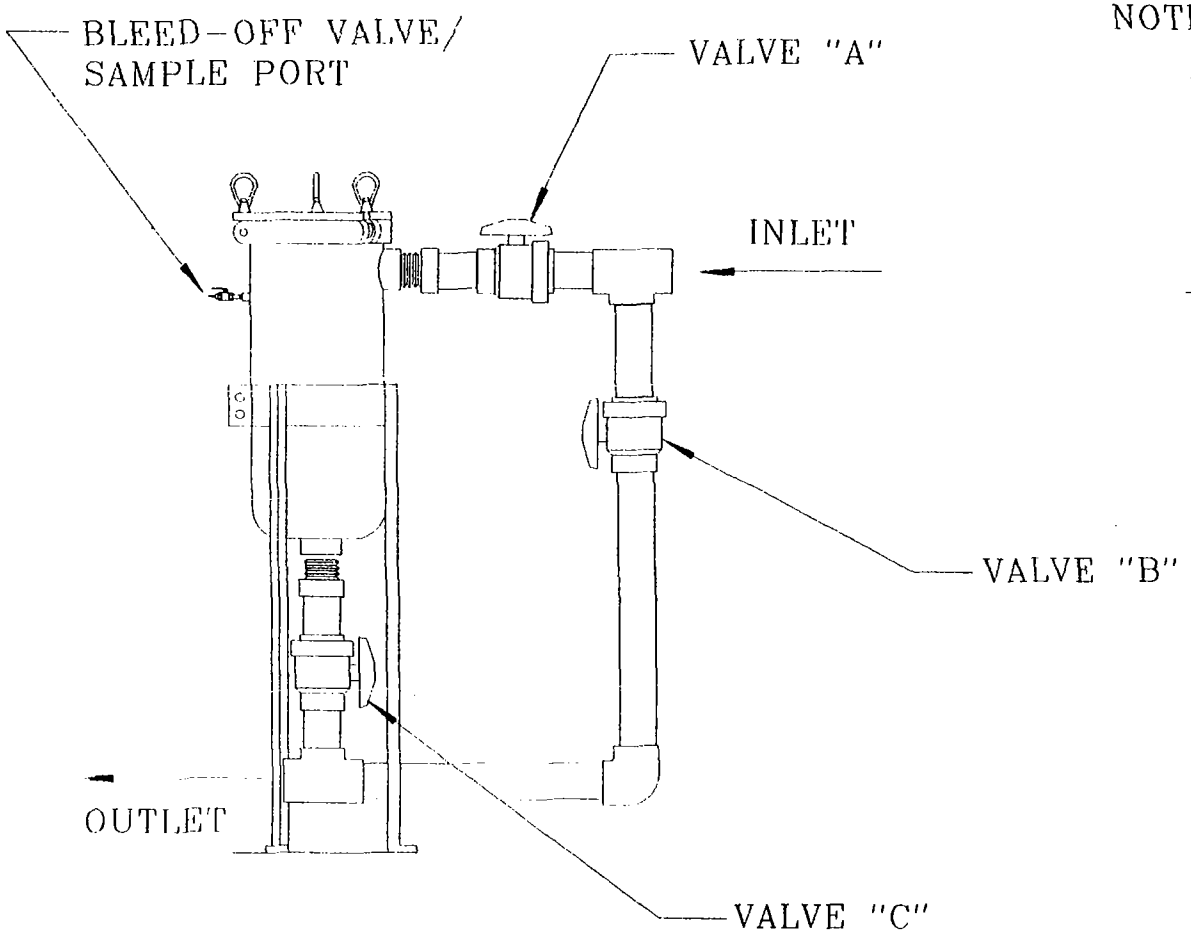
CLOSED VALVES: 2,3,4,7,9,10

TITLE:	DATE:	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.
KALKASKA, MICH. 49646

VALVING FOR
TANK "B"
BACKFLUSHING

SCALE: NONE	TOLERANCES: FR	DRAWN BY
DATE: 01 MARCH 94	ENGINEER	DR. NUMBER:
SHEET		



NOTES:

- TO FLOW THROUGH THE FILTER, VALVES "A" & "C" MUST BE OPEN, AND VALVE "B" MUST BE CLOSED.

- TO BY-PASS THE FILTER, VALVE "B" MUST BE OPEN AND VALVES "A" & "C" MUST BE CLOSED.

ILLUSTRATION "A"

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

ROSEDALE FILTER
VALVING
IDENTIFICATION

SCALE: NONE	TOLERANCES: XXX XX X	DRAWN BY: S. KRELLWITZ
DATE: 26 SEPT 96		
SHEET	ENGINEER	DR. NUMBER: RDVI

SYSTEM MAINTENANCE CONTINUED

8.3) WINTERIZATION

SEE "LONG TERM SHUTDOWN (WINTERIZATION)" SECTION 7.2.2 OF GENERAL SYSTEM INFORMATION.

8.4) BAG FILTER CHANGE-OUT

UNDER NORMAL CONDITIONS FLOW THROUGH THE ROSEDALE FILTER IS ACCOMPLISHED BY HAVING VALVES "A" & "C" OPEN, AND VALVE "B" CLOSED, (SEE ILLUSTRATION "A"). WHEN THE PRESSURE GAUGE ON TOP OF THE ROSEDALE FILTER EXCEEDS 25-30 PSI, IT IS TIME TO CHANGE THE FILTER BAG. TO DO THIS YOU MUST OPEN VALVE "B" AND CLOSE VALVES "A" & "C", (SEE ILLUSTRATION A"). AFTER THE FLOW HAS BEEN DIVERTED AROUND THE FILTER, THE PRESSURE MUST" BE BLED OFF THE FILTER HOUSING BEFORE REMOVING THE LID. (IF NOT YOU MAY END UP WITH WATER UNDER PRESSURE BEING SPRAYED ALL OVER THE PLACE.) OPEN THE BLEED OFF VALVE ON THE FILTER HOUSING (SEE ILLUSTRATION "A"). AFTER THE PRESSURE HAS BEEN RELIEVED, OPEN THE LID, REMOVE EXISTING FILTER BAG, INSTALL NEW FILTER BAG. CHECK LID O-RING PLACEMENT BEFORE CLOSING THE HOUSING LID. OPEN VALVE "A" HALF WAY TO FILL THE FILTER HOUSING WITH WATER, CHECK FOR LEAKAGE AROUND THE LID. IF THERE IS A LEAK CLOSE VALVE "A", RESEAL THE LID AND TRY AGAIN, IF THERE ARE NO LEAKS, OPEN VALVE "C" & "A" ALL THE WAY AND CLOSE VALVE "B". YOU HAVE REPLACED THE FILTER BAG AND FLOW IS AGAIN GOING THROUGH THE THE FILTER UNIT.

8.5) CHLORINATOR

THERE IS (1) SYSTEM CHLORINATOR AND (2) WELL CHLORINATORS IN EACH OF THE TREATMENT BUILDINGS. THE SYSTEM CHLORINATOR IS BEING USED IN THE SYSTEM TO COMBAT BACTERIAL GROWTH, WHICH WHEN IN A SYSTEM WITH HEAVY AMOUNT OF IRON, WILL DEVELOPE A SLIME WHICH COATS THE CARBON AND REDUCES THE CARBON EFFECTIVENESS.

UNIT HAS AN ADJUSTABLE TREATMENT RATE - WE RECOMMEND 2 PPM TREATMENT. UNIT WILL HOLD 45 OF THE 1" CHLORINE TABLETS.

CHLORINATOR SHOULD BE RUN NO MORE THAN NECESSARY, UNDER NORMAL CONDITIONS, ONCE A WEEK FOR 8 HRS IS USUALLY ENOUGH TIME TO KILL THE BACTERIAL GROWTH WHICH MAY HAVE DEVELOPED SINCE THE LAST CHLORINATION.

UNDER EVERY DAY OPERATIONS, RATE VALVE "F" SHOULD BE WIDE OPEN AND RATE VALVES "D" & "E" SHOULD BE CLOSED. WHEN YOU WANT TO INJECT CHLORINE, ALONG WITH RATE VALVE "F" WIDE OPEN, YOU WOULD ALSO OPEN RATE VALVE "D" AND

8.5) CHLORINATOR "CONTINUED"

JUST CRACK VALVE "E" (SEE ILLUSTRATION "B"). AFTER THE SYSTEM HAS RUN FOR A COUPLE OF MINUTES, TAKE A SAMPLE FROM THE ROSEDALE SAMPLE PORT AND TEST FOR THE AMOUNT (PPM) OF CHLORINE. ADJUST RATE VALVE "D" ACCORDING TO THE RESULTS OF THE CHLORINE TEST.

THE WELL CHLORINATORS ARE USED TO KILL BACTERIAL GROWTH FROM THE RECOVERY WELL PUMPS, THROUGH THE UNDERGROUND WELL LINES TO THE BUILDINGS.

UNIT HAS AN ADJUSTABLE TREATMENT RATE - WE RECOMMEND 2 PPM TREATMENT. UNIT WILL HOLD 20 OF THE 1" CHLORINE TABLETS.

WELL CHLORINATORS SHOULD BE RUN NO MORE THAN NECESSARY, UNDER NORMAL CONDITIONS, ONCE A WEEK FOR 6-8 HRS IS USUALLY ENOUGH TIME TO KILL THE BACTERIAL GROUTH WHICH MAY HAVE DEVELOPED SINCE THE LAST CHLORINATION.

UNDER EVERYDAY OPERATIONS, WATER SUPPLY VALVE "G" SHOULD BE CLOSED, ALONG WITH WELL CHLORINATOR VALVES "H" & "I". WHEN YOU WANT TO INJECT CHLORINE INTO THE WELLS, YOU WOULD OPEN WATER SUPPLY VALVE "G" (SEE ILLUSTRATION "C"). YOU WOULD THEN BARELY CRACK OPEN WELL CHLORINATOR VALVE "H" - TO TREAT WELL #1 AND WELL CHLORINATOR VALVE "I" - TO TREAT WELL #2 (SEE ILLUSTRATION "C").

WHEN YOU ARE CHLORINATING WELL #1, WELL #1 SHOULD NOT BE RUNNING, AND WELL #2 IS PRODUCING THE CHLORINE WATER SUPPLY. AND WHEN YOU ARE CHLORINATING WELL #2. WELL #2 SHOULD NOT BE RUNNING, AND WELL #1 IS PRODUCING THE CHLORINE WATER SUPPLY.

8.6) OPENING OF THE CARBON VESSELS FOR SAMPLING/INSPECTION

IF YOU HAVE TO OPEN THE TOP OF THE CARBON VESSELS FOR SAMPLING OR INSPECTION OF THE CARBON, YOU WILL FIRST HAVE TO STOP THE FLOW OF THE SYSTEM. TO DO THIS, PLACE THE RECOVERY WELL PUMP SELECTOR SWITCH TO THE OFF POSITION. NEXT WOULD BE TO RELIEVE THE PRESSURE FROM THE SYSTEM, THIS IS ACCOMPLISHED BY OPENING THE BLEED OFF VALVE ON THE ROSEDALE FILTER (SEE ILLUSTRATION "A"). AFTER THE PRESSURE HAS BEEN RELIEVED, YOU WOULD REMOVE THE CAMLOCK CONNECTION ON THE TOP OF THE VESSEL YOU ARE GOING TO OPEN. YOU WOULD THEN TAKE THE "TOP/BOTTOM WORKS WRENCH" AND LOOSEN THE TOP WORKS UNTIL YOU CAN REMOVE THEM FROM THE VESSEL. ONCE THE TOP WORKS ARE OUT OF THE VESSEL, YOU CAN PERFORM YOUR SAMPLING OR INSPECTION. AFTER YOU HAVE PERFORMED YOUR WORK, YOU WOULD PUT THE TOP WORKS BACK INTO THE VESSEL, RETIGHTEN THEM WITH "TOP/BOTTOM WORKS WRENCH", THEN HOOK THE CAMLOCK CONNECTION BACK TO THE TOP OF THE VESSEL. YOU CAN THEN FOLLOW START-UP AFTER A SHORT TERM SHUTDOWN TO RESTART THE SYSTEM. BE SURE TO CHECK FOR LEAKS AROUND THE TOP WORKS THAT YOU JUST PUT BACK IN, IF THERE IS A LEAK YOU WILL HAVE TO SHUT THE SYSTEM DOWN, BLEED THE PRESSURE AND RETIGHTEN THE TOP WORKS.

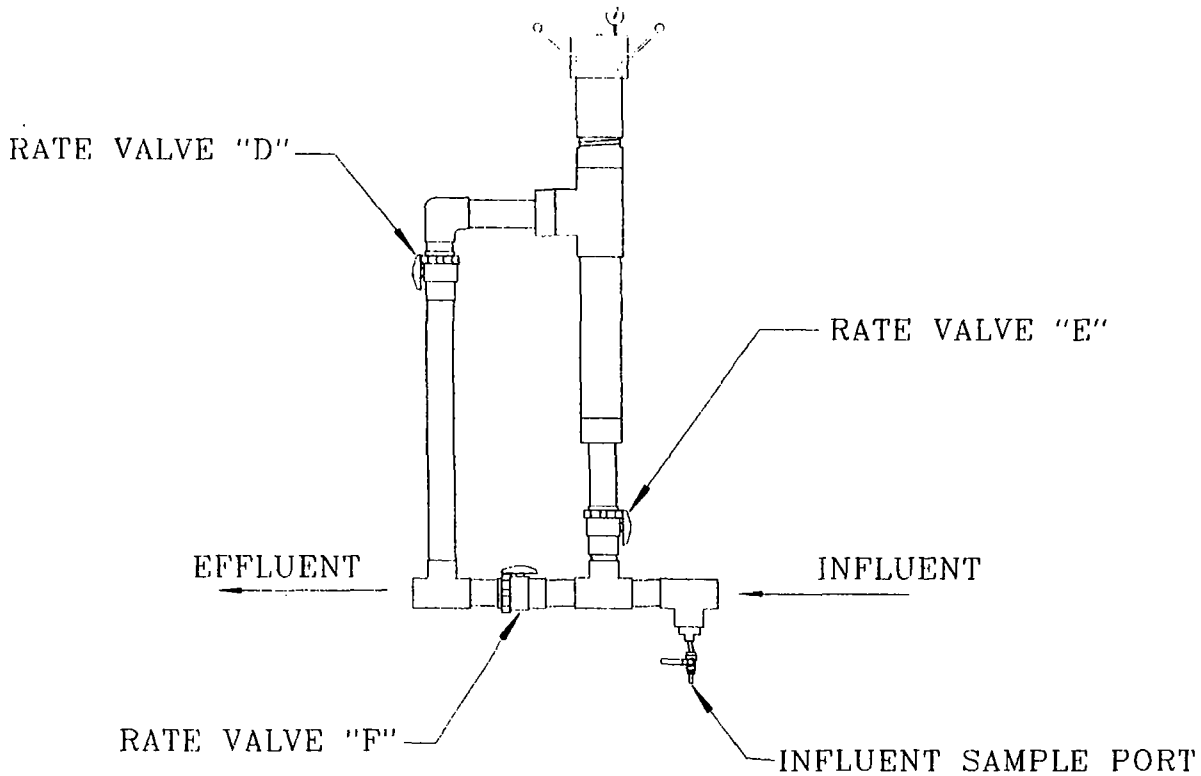


ILLUSTRATION "B"

NOTE
THE DESIGN, SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION, WHICH IS FOR THE SOLE, EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THE INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER WHATSOEVER OR USED WITHOUT THE PRIOR CONSENT OF GREAT LAKES CARBON TREATMENT, INC.

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

CHLORINATOR VALVING

SCALE: NONE	TOLERANCES: XX ±	DRAWN BY: D. KRELLWITZ
DATE: 27 SEPT 95		DR. NUMBER: SEVICY
SHEET	ENGINEER	

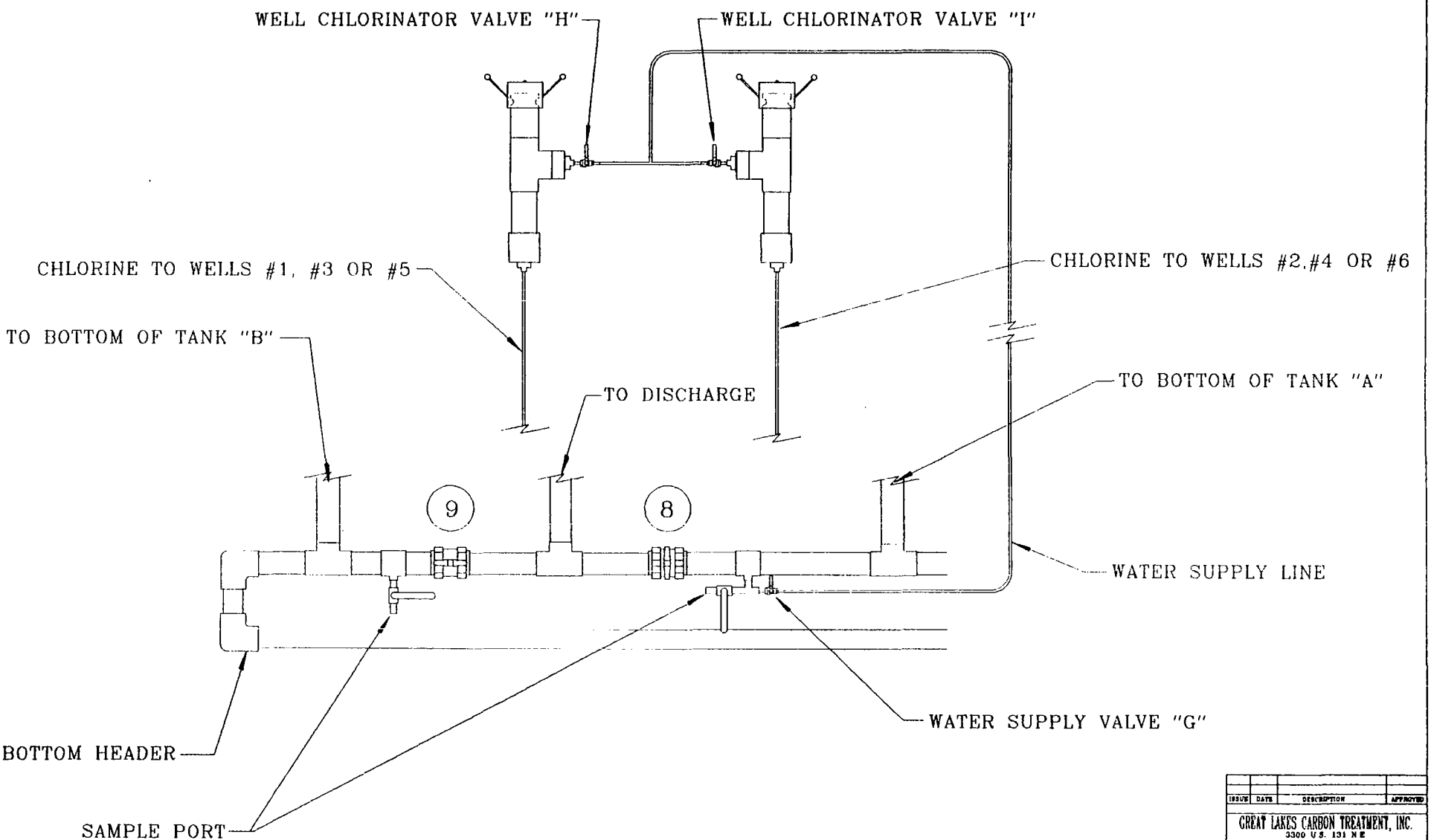


ILLUSTRATION "C"

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

WELL(S)
CHLORINATOR
VALVING

SCALE: NONE	TOLERANCES: XX ±	DRAWN BY:
DATE: 27 SEPT 00		
SHEET	ENGINEER:	DO NOT SCALE DRAWING

NOTE: THE DESIGN, SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION. WHICH IS FOR THE SOLE, EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THE INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER, WHOLE OR PORT WITHOUT THE WRITTEN CONSENT OF GREAT LAKES CARBON TREATMENT, INC.

9 AS BUILT ILLUSTRATIONS

CONCRETE PAD REQUIREMENTS

BUILDING OPENINGS

AS BUILT LAYOUT

INFLUENT ELEVATION

PLAN VIEW FLOW DIAGRAM

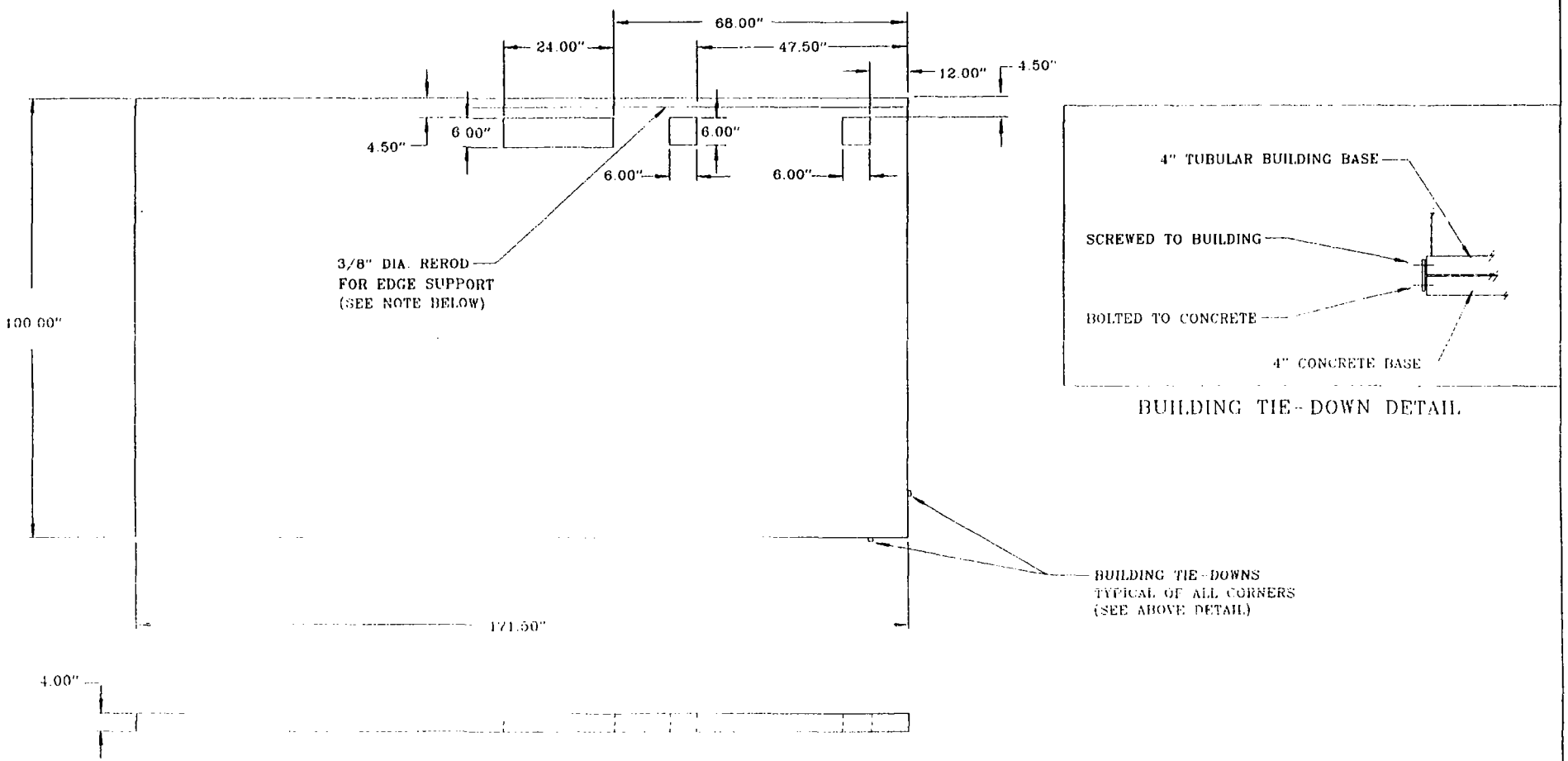
HORIZONTAL FLOW DIAGRAM

STORAGE CABINET/FOOT LOCKER/WRITING AREA ELEVATION

ELECTRICAL CONTROL PANEL FACE

ELECTRICAL CONTROL PANEL (INSIDE PANEL)

CONTROL PANEL WIRING DIAGRAM



BUILDING TIE-DOWN DETAIL

NOTE:

CONCRETE PAD THICKNESS = 4" WITH REINFORCING RODS AROUND THE OPENINGS.

(2) 3/8" DIA. REROD, POSITIONED HORIZONTALLY, HALF WAY BETWEEN FLOOR OPENING AND BUILDING EDGE.

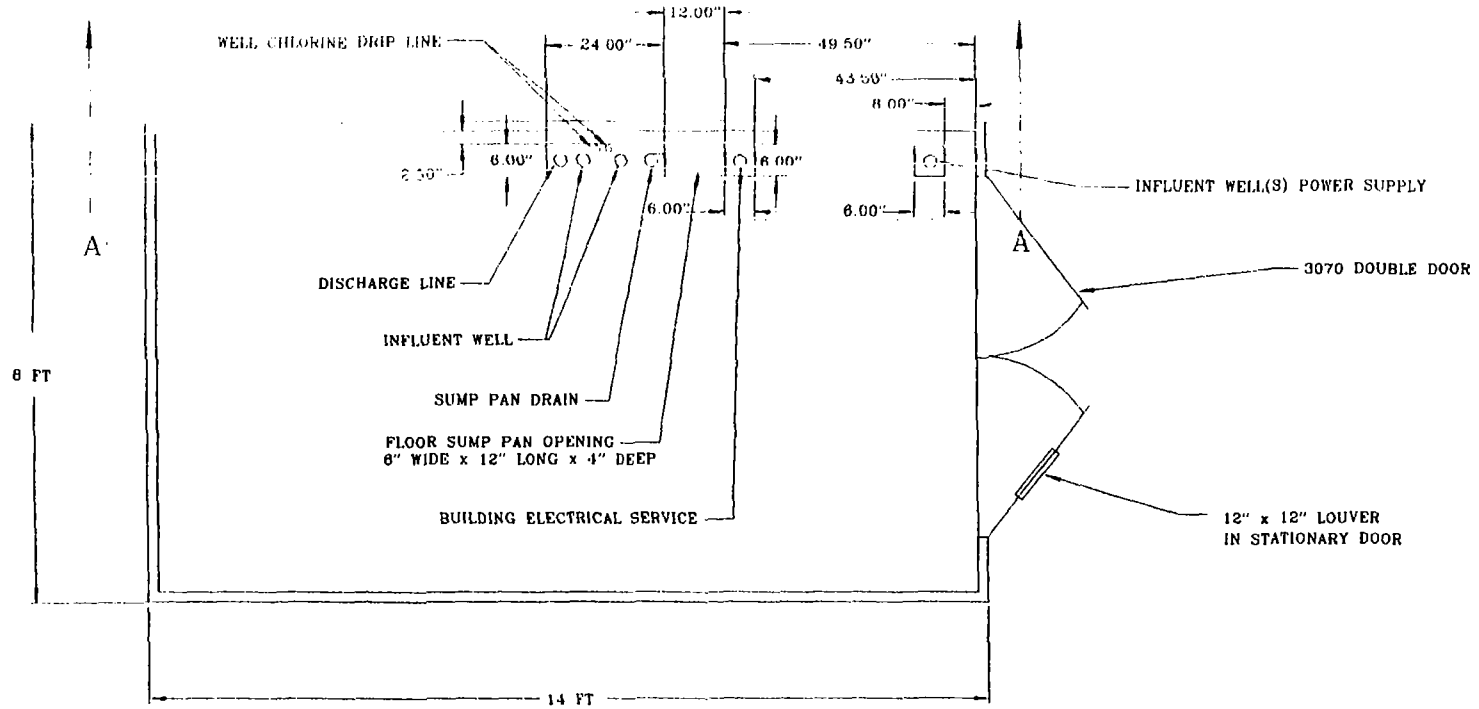
ISSUE	DATE	DESCRIPTION	APPROVED

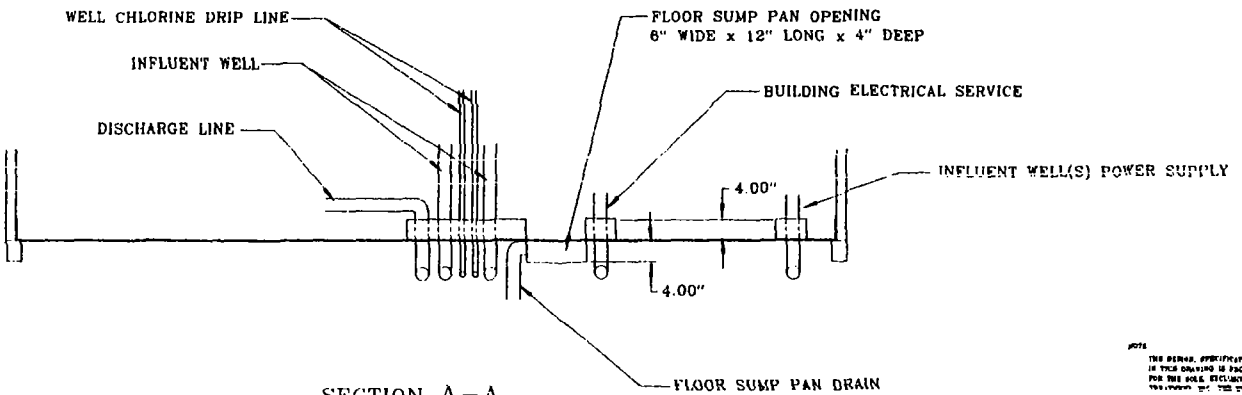
GREAT LAKES CARBON TREATMENT, INC.
3300 U S 131 N E
KALKASKA, MICH 49646
SMITH ENVIRONMENTAL

CONCRETE REQUIREMENTS

SITE OMC CORP. WAUKEGAN, ILLINOIS

SCALE NONE	TOLERANCES XX	DRAWN BY
DATE 16 JULY 1998		S. KRELLWITZ
SHEET	ENGINEER	DR. NUMBER: SKWCB





SECTION A–A

NOTE
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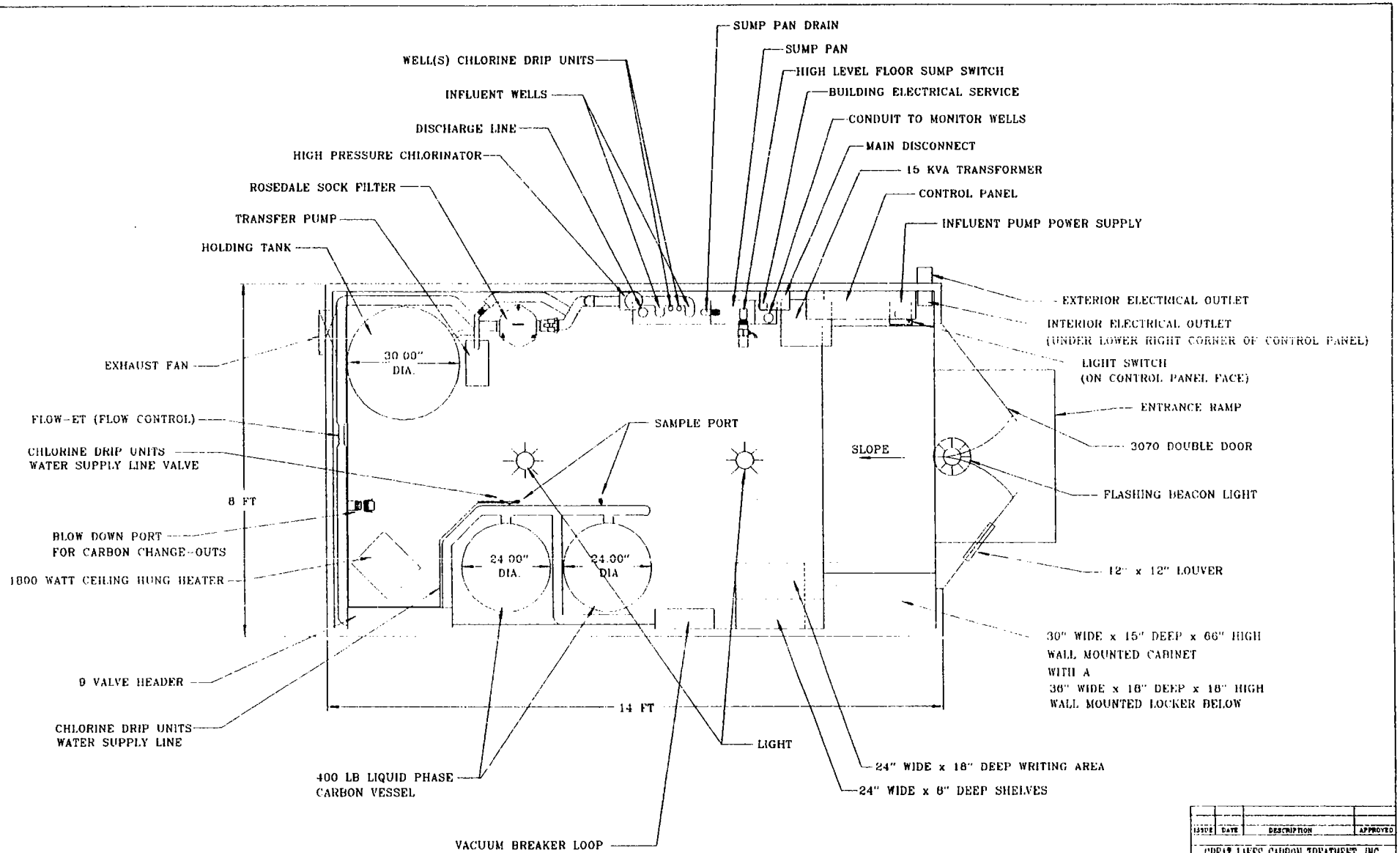
ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646
SMITH ENVIRONMENTAL
8' x 14' STEEL BUILDING
BUILDING OPENINGS
SITE GMC CORP. WAUKEGAN, ILLINOIS

SCALE NONE	TOLERANCES FOR	DRAWN BY
DATE 15 JULY 1996	ENGINEER	E. KRELL/PTE.
SHEET		DR. NUMBER 4SEWIBO



NOTE:
AN INDUSTRIAL ROLLING STEP LADDER
WILL BE FURNISHED WITH THE BUILDING.

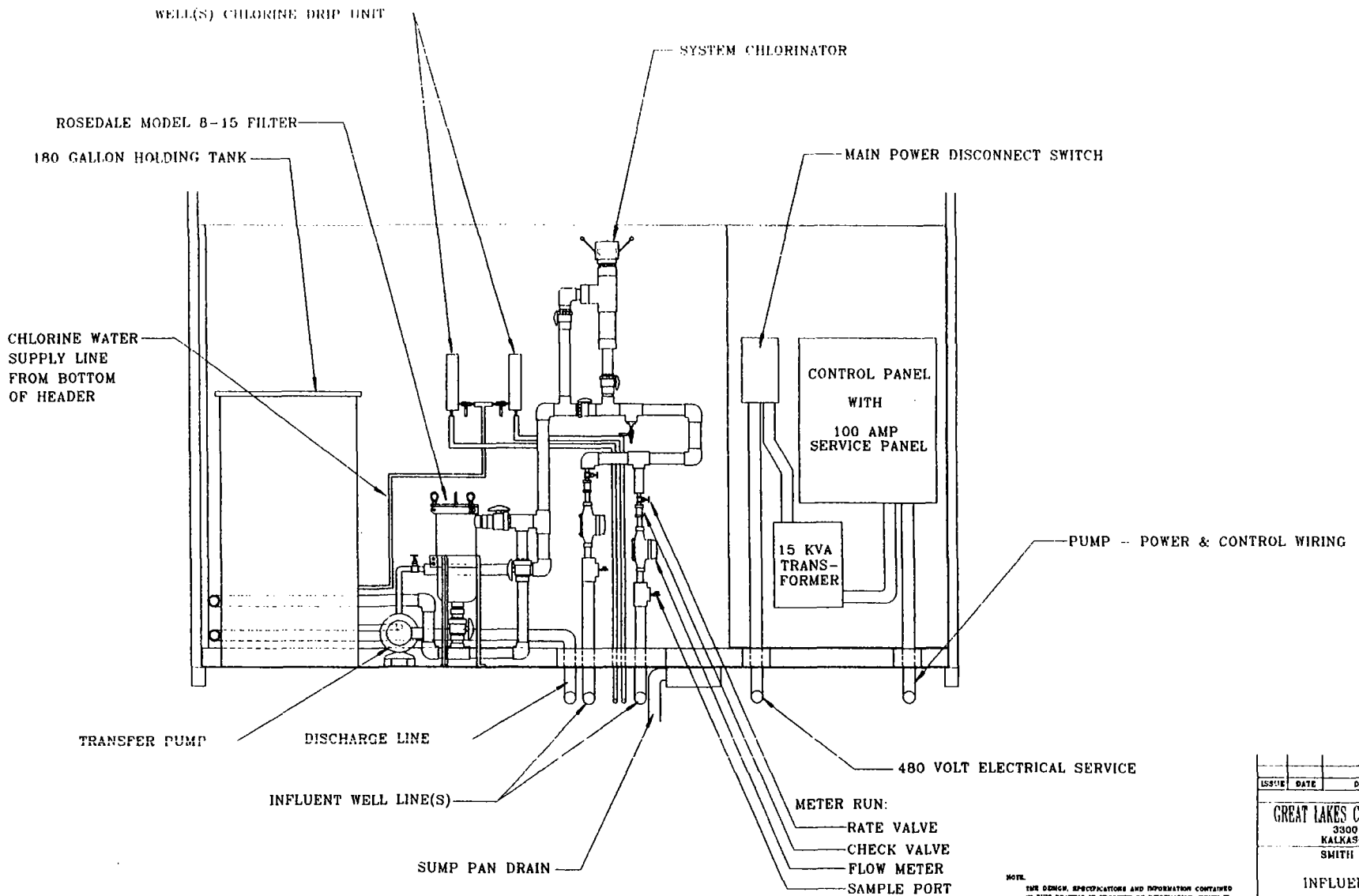
NOTE
THE DESIGN SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION WHICH IS FOR THE SOLE EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THIS INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER, SHAPE OR FORM WITHOUT THE WRITTEN CONSENT OF GREAT LAKES CARBON TREATMENT, INC.

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

SMITH ENVIRONMENTAL
8' x 14' STEEL BUILDING
WITH (2) 400 LBS VESSELS
AS BUILT LAYOUT
SITE: OMC CORP. WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XX	DRAWN BY
DATE: 18 JULY 1996		S. KRELLWITZ
SHEET	ENGINEER:	DR NUMBER



NOTE.

THE DESIGN, SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION, WHICH IS FOR THE SOLE, EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THE INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER SHAPE OR FORM WITHOUT THE WRITTEN CONSENT OF GREAT LAKES CARBON TREATMENT INC

ISSUE	DATE	DESCRIPTION	APPROVED

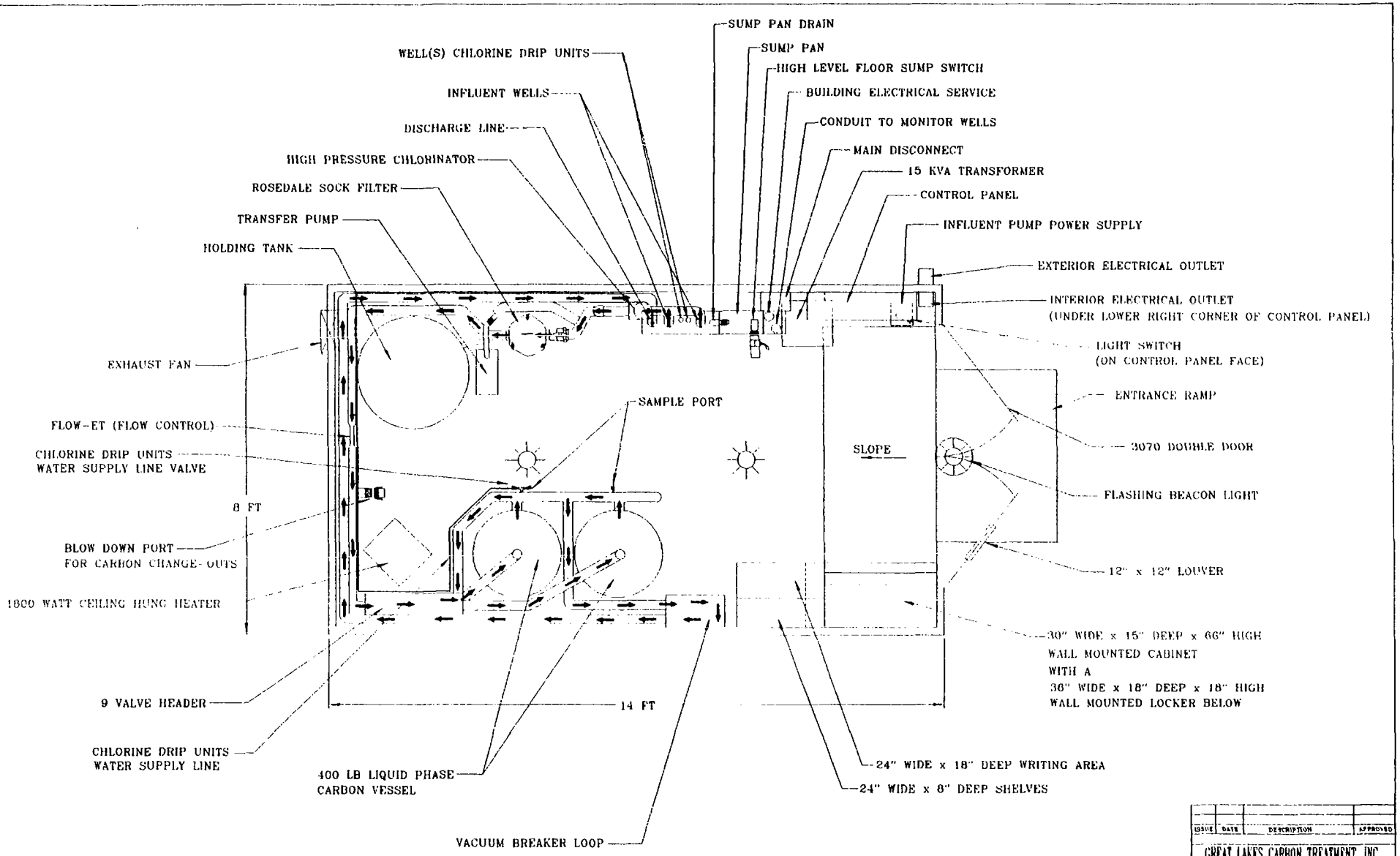
GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

SMITH ENVIRONMENTAL

INFLUENT ELEVATION

SITE: OMC CORP. WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XX / X	DRAWN BY: S. KRELLWITZ
DATE: 29 JULY 1998	ENGINEER:	DR. NUMBER: 4SKELV
SHEET		



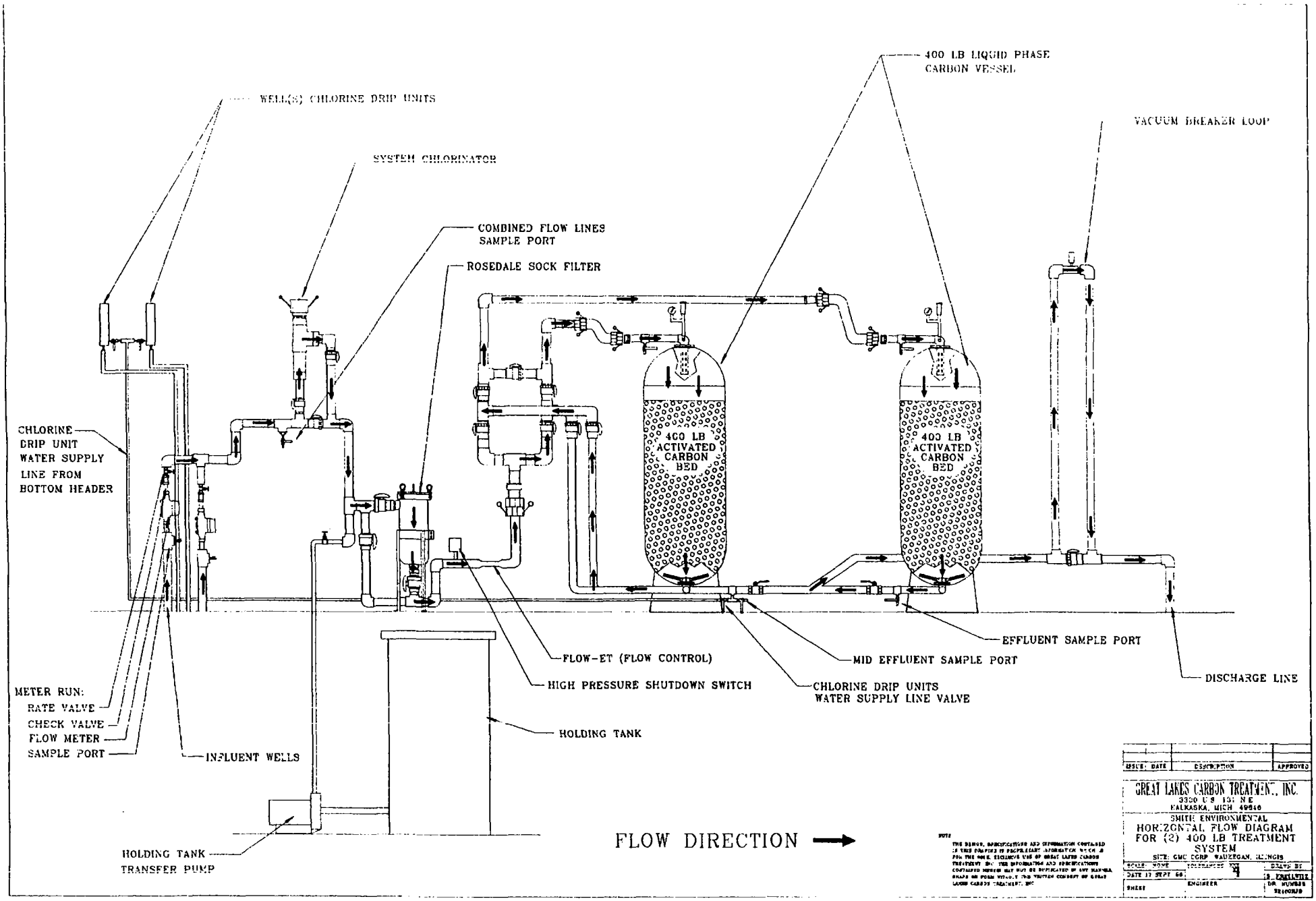
NOTE:
AN INDUSTRIAL ROLLING STEP LADDER
WILL BE FURNISHED WITH THE BUILDING.

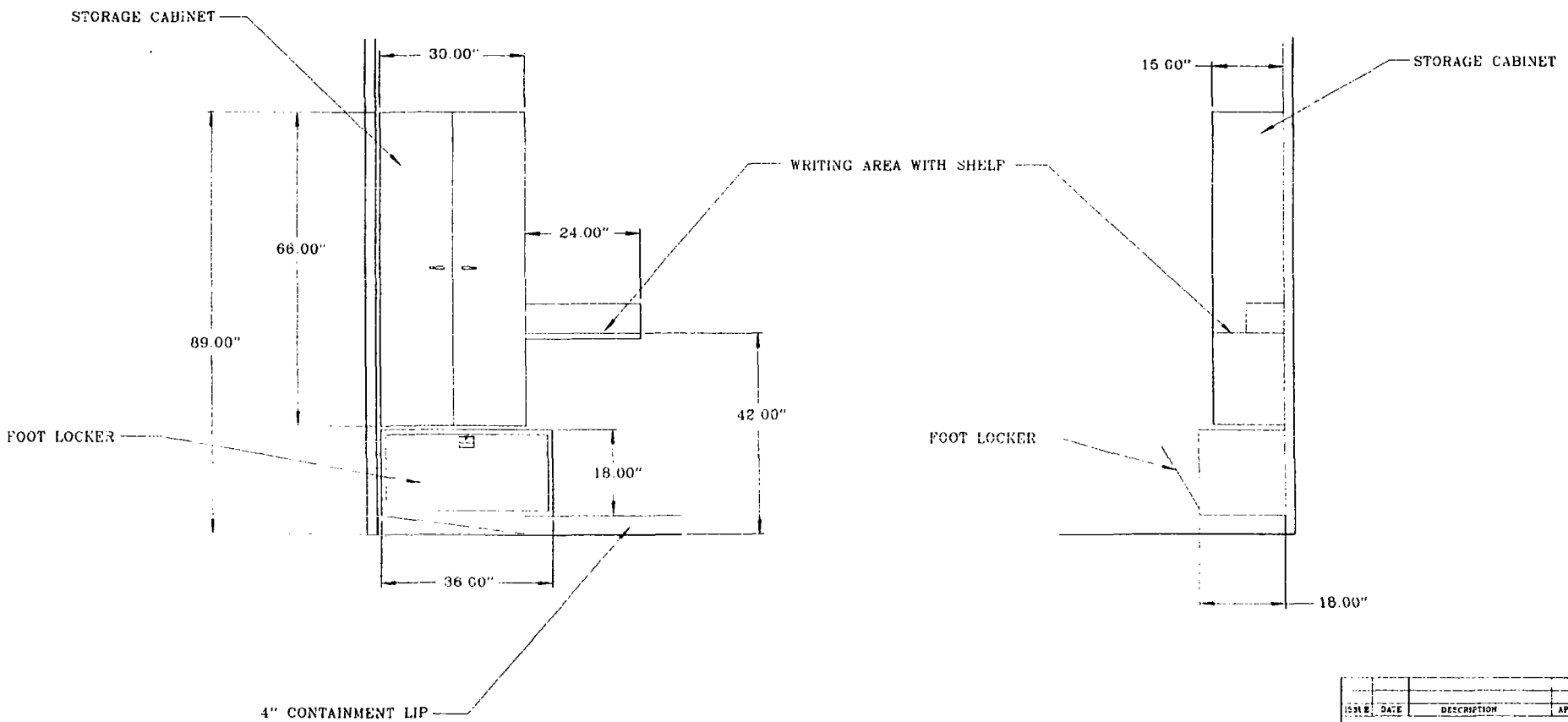
ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U S 131 N E
KALKASKA, MICH 49646

SMITH ENVIRONMENTAL
8' x 14' STEEL BUILDING
WITH (2) 400 LBS VESSELS
PLAN VIEW, FLOW DIAGRAM
SITE, OMC CORP. WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XX ± .03	DRAWN BY
DATE 10 SEPT 99		2 REVISIONS
SHEET	ENGINEER	DG NUMBER 2S400PFD


400 LB LIQUID PHASE CARBON VESSEL
WELL(S) CHLORINE DRIP UNITS
VACUUM BREAKER LOOP
SYSTEM CHLORINATOR
COMBINED FLOW LINES SAMPLE PORT
ROSEDALE SOCK FILTER
CHLORINE DRIP UNIT WATER SUPPLY LINE FROM BOTTOM HEADER
400 LB ACTIVATED CARBON BED
400 LB ACTIVATED CARBON BED
EFFLUENT SAMPLE PORT
MID EFFLUENT SAMPLE PORT
DISCHARGE LINE
FLOW-ET (FLOW CONTROL)
HIGH PRESSURE SHUTDOWN SWITCH
CHLORINE DRIP UNITS WATER SUPPLY LINE VALVE
METER RUN:
RATE VALVE
CHECK VALVE
FLOW METER
SAMPLE PORT
INFLUENT WELLS
HOLDING TANK
HOLDING TANK TRANSFER PUMP
FLOW DIRECTION
ISSUE: DATE
DESCRIPTION
APPROVED
GREAT LAKES CARBON TREATMENT, INC.
3330 U.S. 131 N.E.
KALKASKA, MICH. 49646
SMITH ENVIRONMENTAL
HORIZONTAL FLOW DIAGRAM FOR (2) 400 LB TREATMENT SYSTEM
SITE: GMC CORP. WAUKEGAN, ILLINOIS
SCALE: NONE
TOLERANCES: XX
DRAWN BY:
DATE 17 SEPT 96
ENGINEER
DR. NUMBER
SHEET
REVISED



NOTE
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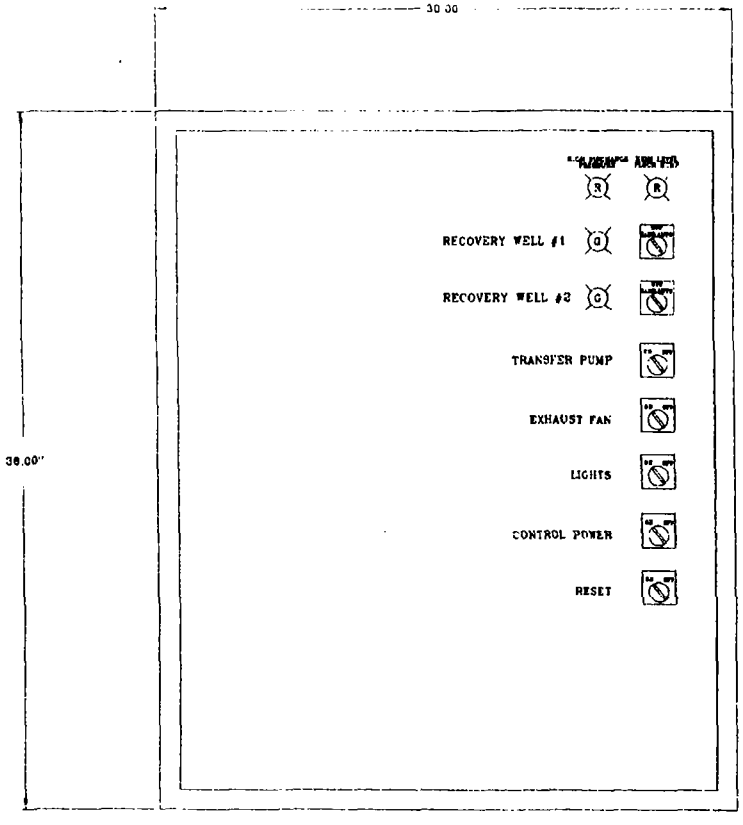
ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
5560 U.S. 131 N.E.
KALKASKA, MICH. 49646
SMITH ENVIRONMENTAL

STORAGE CABINET/FOOT LOCKER/
WRITING AREA ELEVATIONS

SITE: GMC CORP. WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XXX ± .X ± .X	DRAWN BY: S. KRELLWITZ
DATE: 16 JULY 1998		
SHEET	ENGINEER:	DR. NUMBER: SEWICUPE



BILL OF MATERIALS

ITEM	QTY.	DESCRIPTION	MANUFACTURE
PANEL BOX	1	30" W x 36" H x 10" D ENCLOSURE, SINGLE DOOR, CARBON STEEL	HOFFMAN
		MODEL # A-3636SC10CS	
SWITCH	5	OFF/ON SWITCH, 800H – HR3A ALLEN BRADLEY 2 POSITION SWITCH	ALLEN BRADLEY
SWITCH	2	HAND/OFF/AUTO SWITCH, 800H – JR3A ALLEN BRADLEY 3 POSITION SWITCH	ALLEN BRADLEY
RESET BUTTON	1	RESET BUTTON, 800H – A1A ALLEN BRADLEY RESET BUTTON	ALLEN BRADLEY
PILOT LIGHT	2	GREEN PILOT LIGHT MODEL # 800T-Q10G	ALLEN BRADLEY
PILOT LIGHT	2	RED PILOT LIGHT MODEL # 800T-Q10R	ALLEN BRADLEY

NOTE:
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ISSUE	DATE	DESCRIPTION	APPROVED

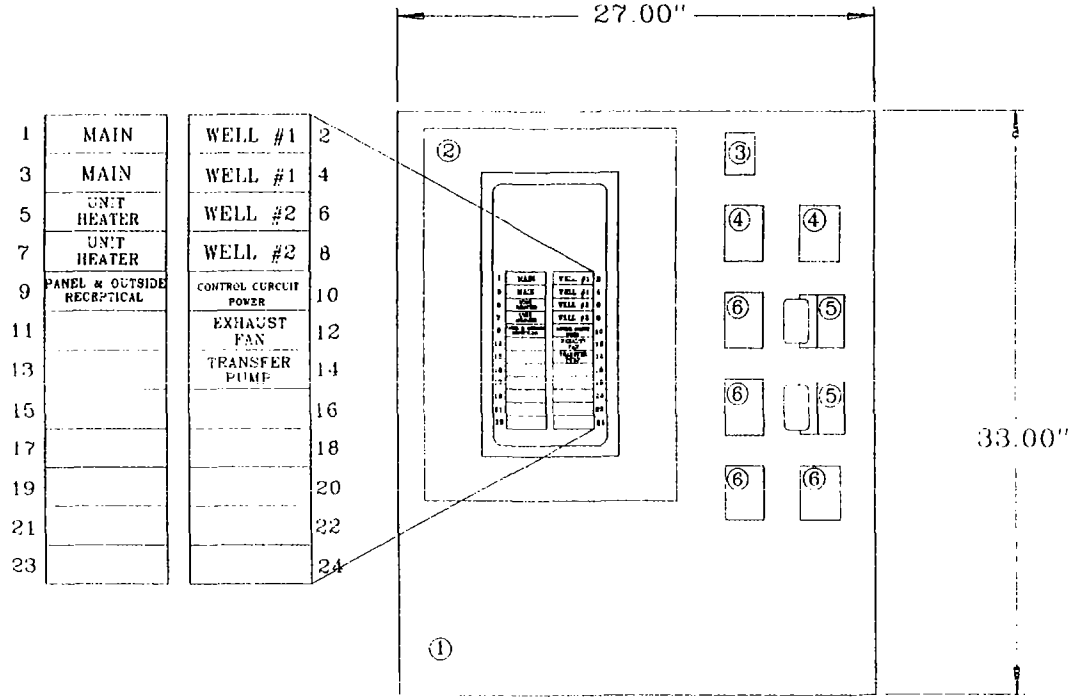
GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E
KALKASKA, MICH. 49646

SMITH ENVIRONMENTAL

CONTROL PANEL (FACE)

SITE: ONC CORP WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XXX XX X	DRAWN BY: S. KRELLWITZ
DATE: 26 AUG. 98		
SHEET	ENGINEER:	DR. NUMBER SEWICPF



BILL OF MATERIALS

ITEM #	ITEM	DESCRIPTION	MANUFACTURE	QTY.
①	SUBPLATE	27" W x 33" H SUBPLATE	HOFFMAN	1
②	SERVICE PANEL	125 AMP ELECTRICAL SERVICE PANEL	SQUARE "D"	1
③	TIMER	36X SERIES TIME DELAY RELAY	SIGNALINE	1
④	RELAY	TYPE N, AC RELAY	ALLEN-BRADLEY	2
⑤	LEVEL CONTROLS	LEVEL CONTROL, MODEL # 1G2D4	WARRICK	2
⑥	RELAY	TYPE PK MASTER CONTROL RELAY	ALLEN-BRADLEY	4

ISSUE	DATE	DESCRIPTION	APPROVED

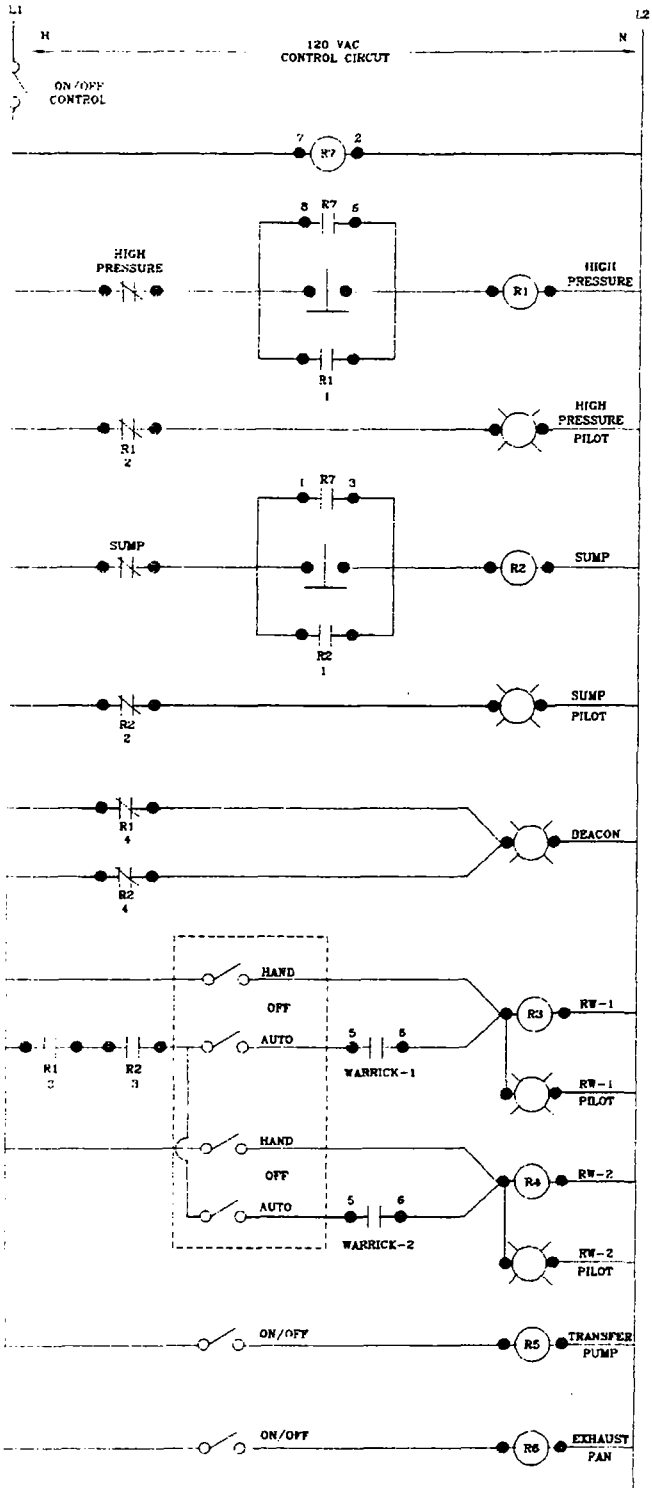
GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA MICH. 49646

SMITH ENVIRONMENTAL

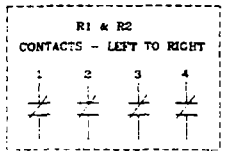
CONTROL PANEL (INSIDE)

SITE: OMC CORP. WAUKEGUN, ILLINOIS

SCALE: NONE	TOLERANCES: XXX	DRAWN BY:
DATE: 3 SEPT. 96		S. KRELLWITZ
SHEET:	ENGINEER:	DN NUMBER: SEWCP1



NOTE:



NOTE:

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ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

SMITH ENVIRONMENTAL

ELECTRICAL LINE DIAGRAM

SITE: OMC CORP. WAUKEGAN, ILLINOIS

SCALE: NONE	TOLERANCES: XXX / XX / X	DRAWN BY:
DATE: 18 SEPT. 96		S. KRELLWITZ
SHEET	ENGINEER:	DR. NUMBER SEWIELD

10 GENERAL INFORMATION (MANUFACTURER'S LITERATURE)

10.1) SUBMERSIBLE PUMP

10.2) FLO-ET FLOW CONTROL

10.3) FLOW METER

10.4) ROSEDALE FILTER

10.5) HOLDING TANK

10.6) TRANSFER PUMP

10.7) CARBON VESSELS

10.8) CARBON

10.9) PRESSURE SWITCH

10.10) FLOOR SUMP LEVEL SWITCH

10.11) ROLLING STEP LADDER

10.12) CABINET

10.13) FOOT LOCKER

10.14) ELECTRICAL

10.15) MISCELLANEOUS

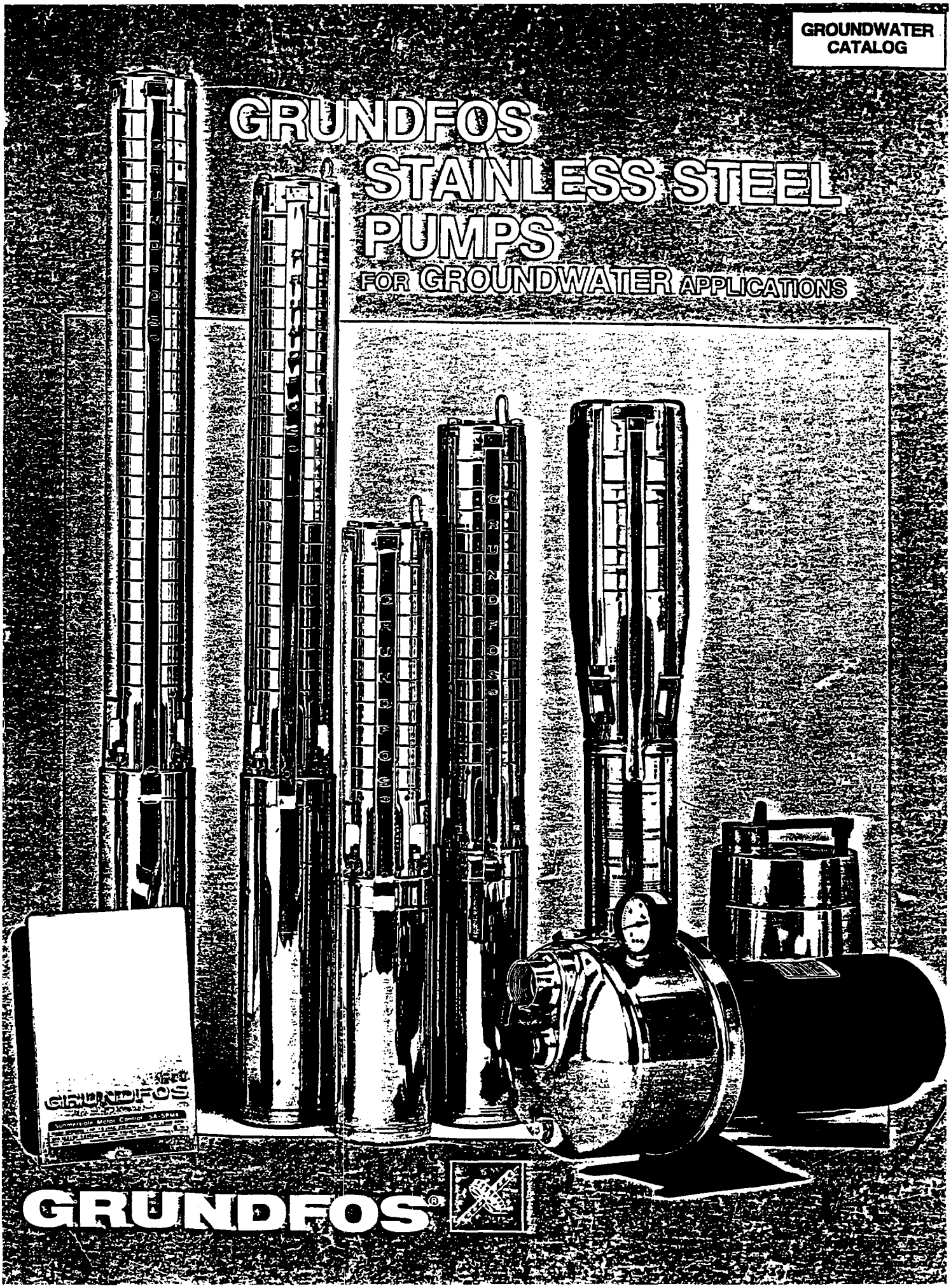
10 1) SUMERSIBLE PUMP

GRUNDFOS SUBMERSIBLE WELL PUMP
MODEL # 10S03-6, 1/3 HP, 230 V SINGLE PHASE

GROUNDWATER CATALOG

GRUNDFOS STAINLESS STEEL PUMPS

FOR GROUNDWATER APPLICATIONS

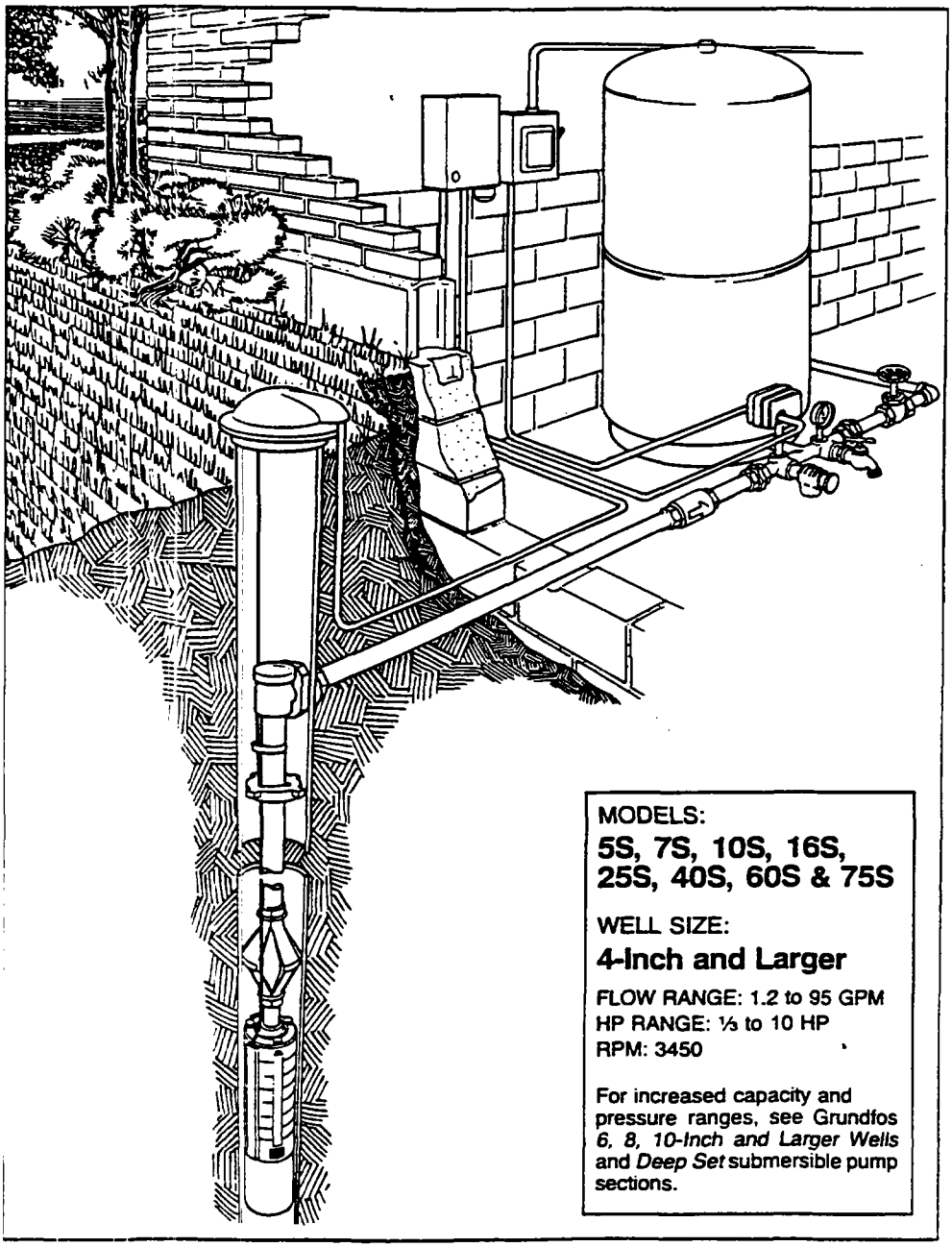


GRUNDFOS®

SECTION 2

GRUNDFOS 4-inch Stainless Steel Submersible Pumps

- General
- Curves and Charts
- Materials of Construction



MODELS:
5S, 7S, 10S, 16S, 25S, 40S, 60S & 75S

WELL SIZE:
4-Inch and Larger

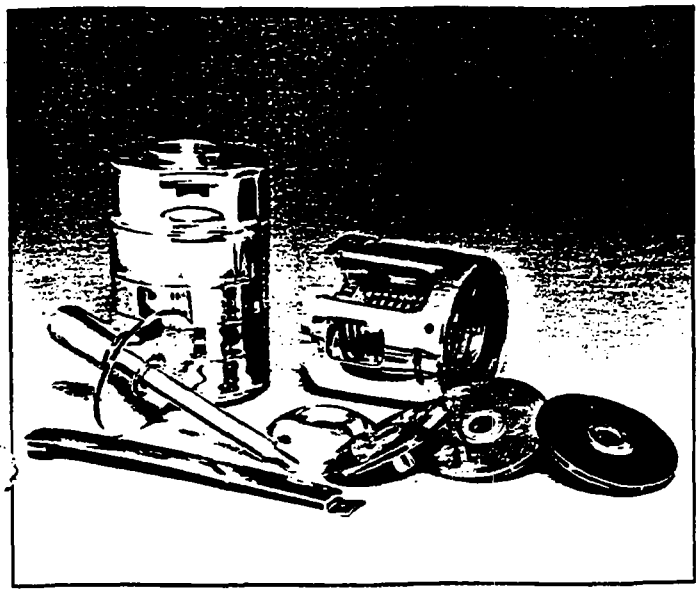
FLOW RANGE: 1.2 to 95 GPM
HP RANGE: ⅓ to 10 HP
RPM: 3450

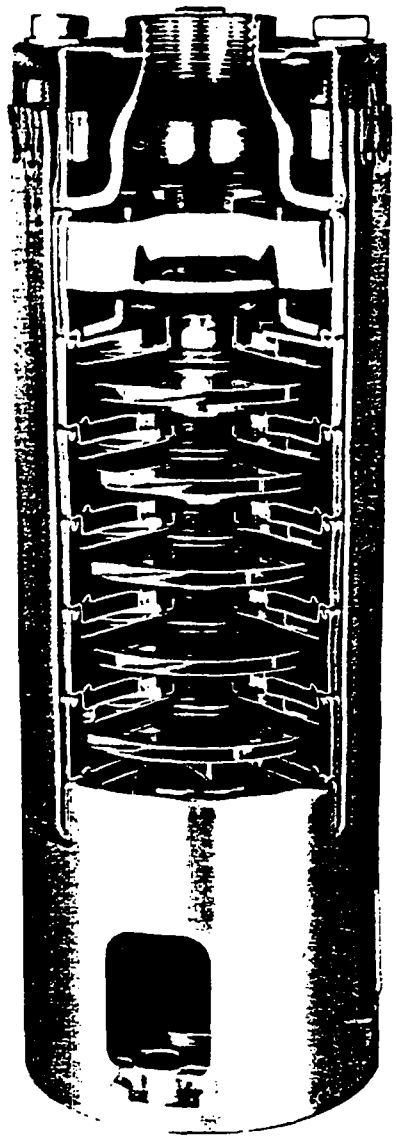
For increased capacity and pressure ranges, see Grundfos *6, 8, 10-Inch and Larger Wells* and *Deep Set* submersible pump sections.

APPLICATIONS: Residential water supply for 4-inch and larger wells.

Pump Selection Guide

MODEL	MIN. WELL SIZE	FLOW RANGE (GPM)	MAX. WORKING HEAD (FEET)	MAX. WORKING HEAD (PSI)
5S	4"	1.2-7	870	377
7S	4"	3-10	680	294
10S	4"	5-14	900	390
16S	4"	10-20	980	416
25S	4"	18-32	630	273
40S	4"	24-55	755	327
60S	4"	40-75	505	219
75S	4"	45-95	460	199

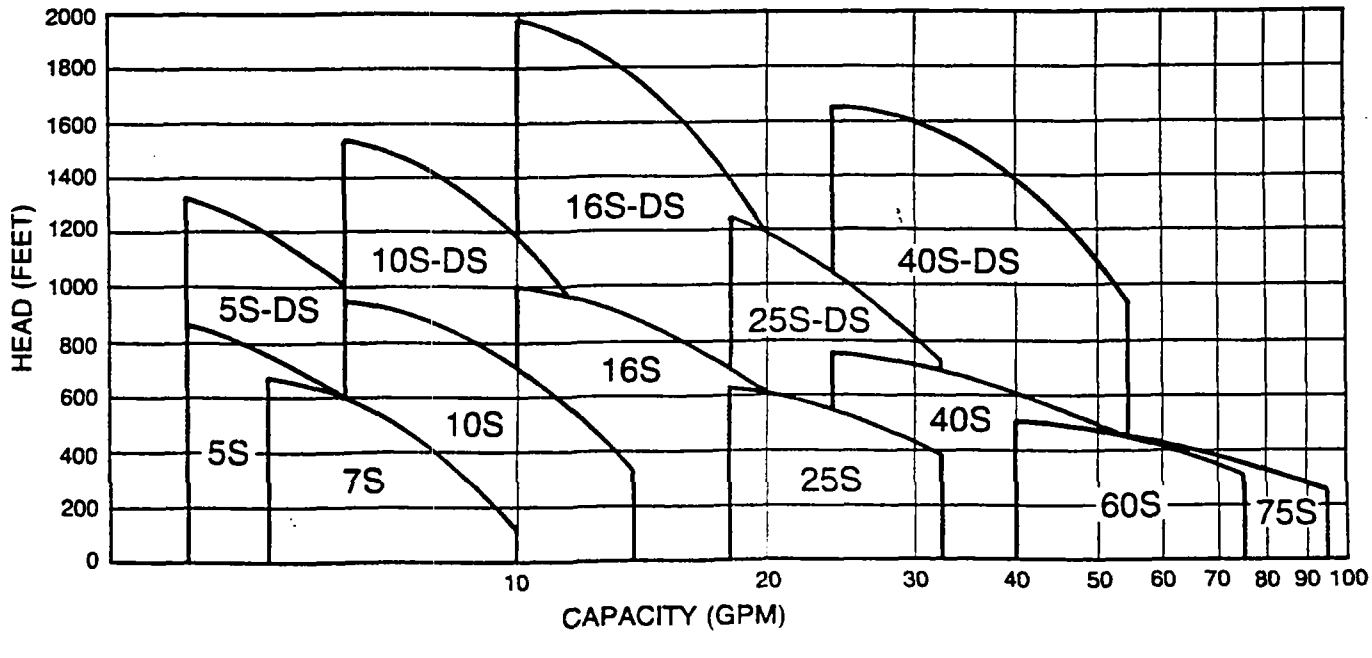




Features

- ☑ Smooth safety hook prevents frayed safety line.
- ☑ Built-in, jam-free check valve designed for failsafe operation.
- ☑ ***SnapGuard***™ cable guard is designed for easy installation and removal. Holds tight and provides maximum protection to motor leads.
- ☑ ***PrecisionForm***™ impellers are fabricated from stainless steel to provide long pump life, maximum hydraulic efficiency and top pump performance.
- ☑ Exclusive ***PrimeInducer***™ provides maximum pump protection from dry-run damage during low water situations.
- ☑ Pump inlet is totally screened to prevent damage from debris.
- ☑ All Grundfos submersibles are performance tested at the factory to verify specified performance.

4-Inch

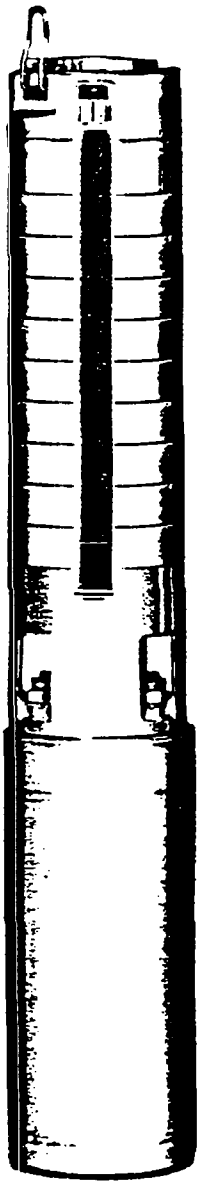


NOTE: For Deep Set models see Section 4.

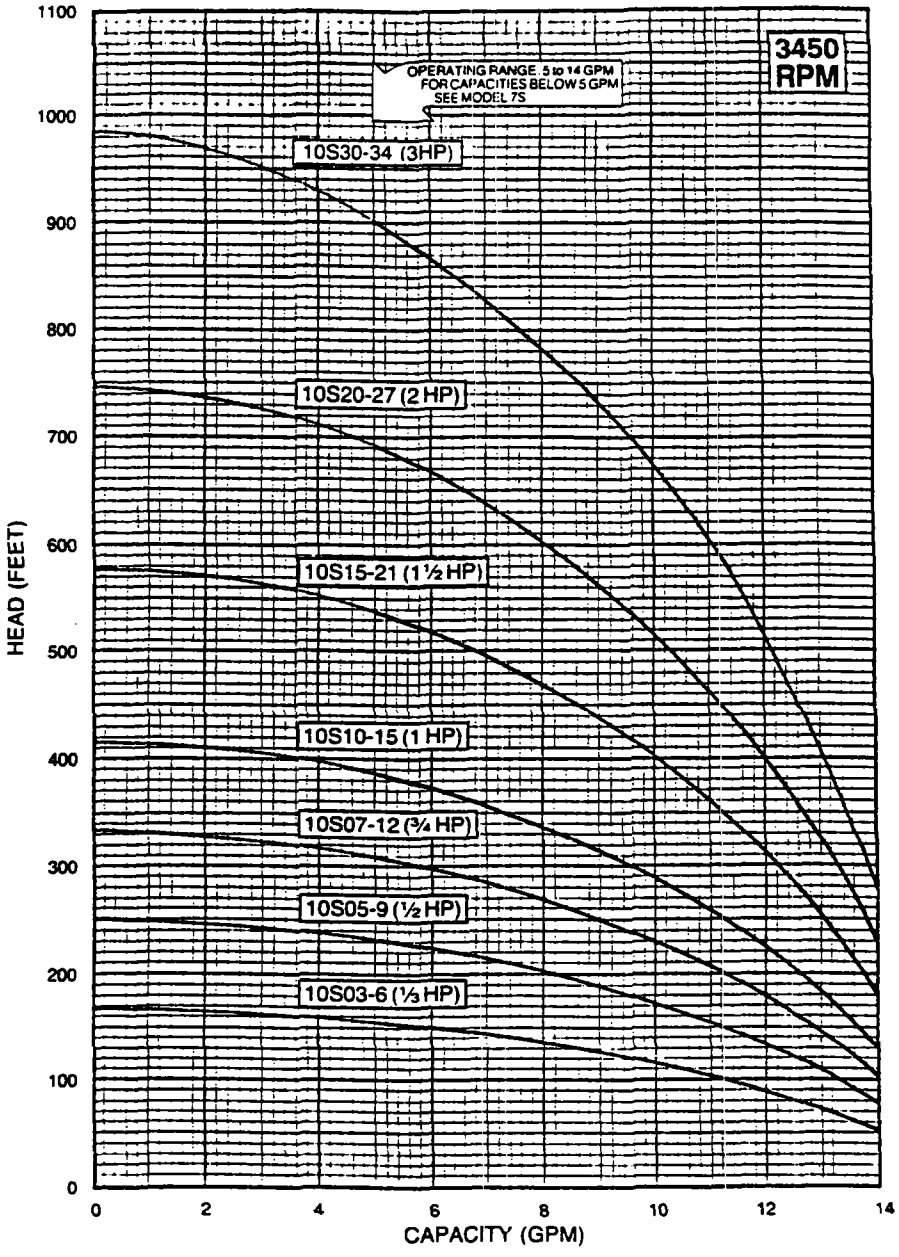
MODEL 10S — 10 GPM — GRUNDFOS

FLOW RANGE
5 to 14 GPM

PUMP OUTLET
1¼" NPT



PERFORMANCE CURVES



DIMENSIONS AND WEIGHTS

MODEL NO.	HP	LENGTH (INCHES)	WIDTH (INCHES)	APPROX. UNIT SHIPPING WT. (LBS.)
10S03-6	⅓	21 5/8	3 15/16	26
10S05-9	½	24 5/8	3 15/16	29
10S07-12	¾	27 5/8	3 15/16	32
10S10-15	1	30 ½	3 15/16	34
10S15-21	1 ½	37 7/8	3 15/16	44
10S20-27	2	42	3 15/16	49
10S30-34	3	54 7/8	3 15/16	83

Specifications are subject to change without notice.

GRUNDFOS 10 GPM MODEL 10S

SELECTION CHARTS

(Ratings are in GALLONS PER HOUR – GPH)

FLOW RANGE
5 to 14 GPM

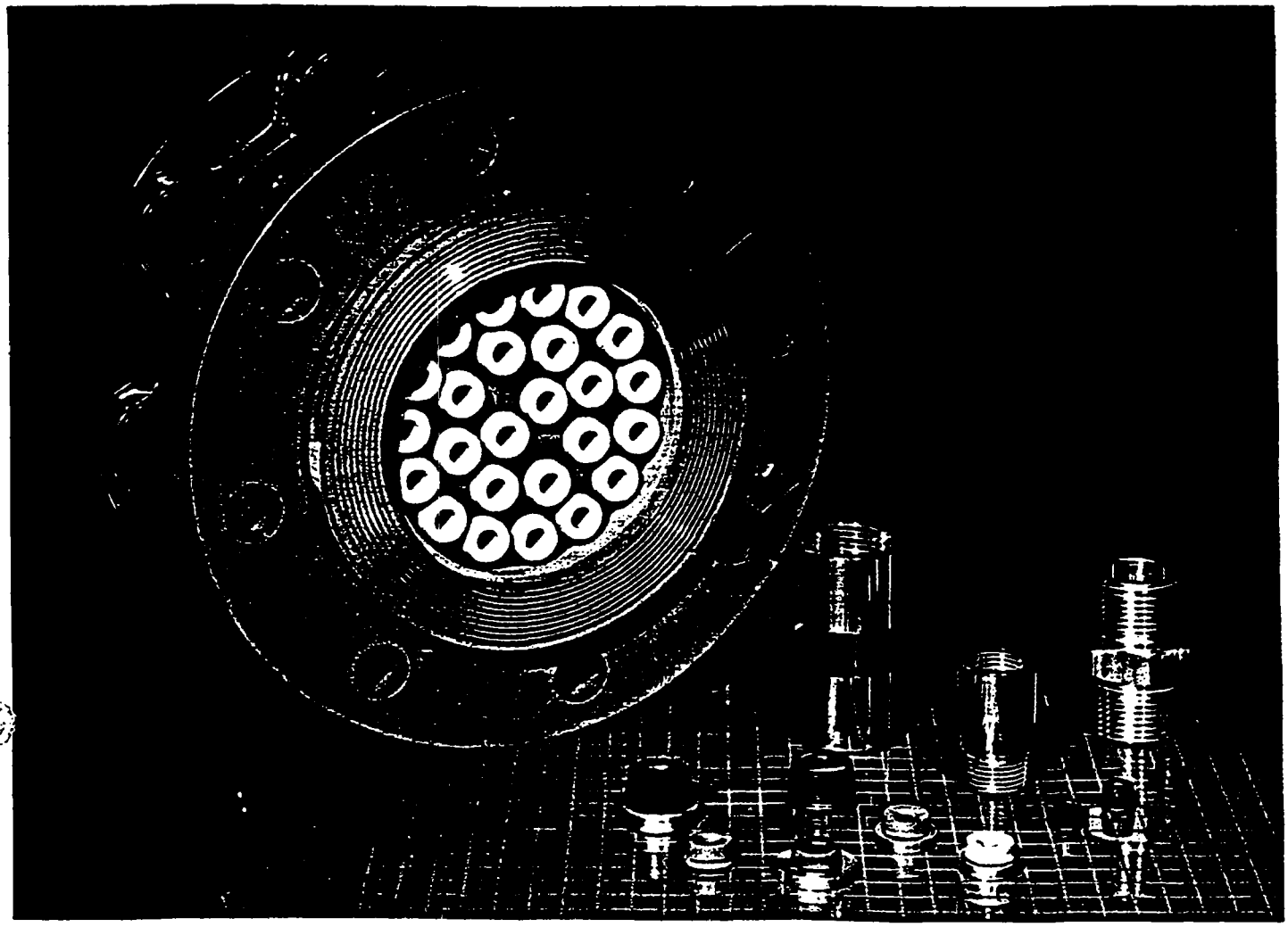
PUMP OUTLET
1¼" NPT

PUMP MODEL	HP	PSI	DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																									
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	110
10S03-6	⅓	0		856	811	766	665	564	398	233																	
		20	840	790	741	636	532	315	98																		
		30	790	706	621	501	380	190																			
		40	712	606	500	250																					
		50	588	447	306	153																					
		60	464	232																							
Shut-off PSI:			64	55	47	38	29	21	12	3																	
10S05-9	½	0				847	802	746	685	626	568	499	393	207													
		20		835	785	727	667	608	549	472	347	122															
		30	828	777	718	658	600	538	457	320	73																
		40	768	708	649	590	528	440	290																		
		50	699	639	581	516	422	258																			
		60	630	572	504	403	223																				
Shut-off PSI:			100	92	83	74	56	57	48	40	31	23	14	5													
10S07-12	¾	0					857	828	791	748	703	658	614	570	521	457	362										
		20			849	817	778	734	689	644	601	556	503	432	323	155											
		30		845	812	771	727	682	637	594	549	494	418	302	121												
		40	840	806	765	720	675	631	587	541	484	403	279	85													
		50	800	758	713	668	624	580	533	473	387	254															
		60	751	706	661	617	573	525	462	370	228																
Shut-off PSI:			137	129	120	111	103	94	85	77	68	59	51	42	33	25	16										
10S10-15	1	0							843	816	785	750	714	678	643	608	573	489	226								
		20					835	807	774	739	703	667	632	598	562	522	472	312									
		30				831	802	769	734	698	662	627	592	556	515	463	393	153									
		40		851	827	797	764	728	692	656	621	587	550	508	454	380	276										
		50	848	823	792	758	723	686	651	616	581	544	500	444	366	256	99										
		60	818	787	753	717	681	645	611	576	538	493	434	352	235												
Shut-off PSI:			174	165	157	148	139	131	122	113	105	96	87	79	70	61	53	35	10								
10S15-21	1½	0									853	836	817	795	772	747	721	669	594	511	375						
		20							848	831	811	788	764	739	713	687	661	611	533	415	176						
		30						845	828	807	784	760	735	709	683	657	632	583	495	344							
		40					843	825	804	781	756	731	705	679	653	628	604	552	449	248							
		50				840	822	800	777	752	727	701	675	650	625	600	575	519	389	120							
		60		854	837	818	797	773	748	723	697	671	646	621	596	571	544	478	308								
Shut-off PSI:				237	229	220	211	203	194	185	177	168	159	151	142	133	125	107	81	55	29						
10S20-27	2	0												847	834	819	803	766	707	647	589	500	284				
		20										844	830	814	797	779	760	720	660	602	541	425	87				
		30									842	827	812	795	776	757	737	697	638	580	514	373					
		40							852	839	825	809	792	773	754	734	714	674	615	556	483	309					
		50						850	837	823	807	789	770	751	731	711	691	651	593	531	445	228					
		60					848	835	820	804	786	767	748	728	708	688	668	629	570	502	398	126					
Shut-off PSI:							285	276	268	259	250	242	233	224	216	207	198	181	155	129	103	68	25				
10S30-37	3	0																841	808	769	725	667	596	519	399		
		20														847	838	816	778	736	691	634	562	472	309		
		30													846	836	826	802	762	719	675	617	545	444	252		
		40												845	835	824	813	787	746	702	658	601	525	411	185		
		50											843	833	822	811	798	772	729	685	641	585	504	372	105		
		60										842	832	821	809	796	783	756	712	668	625	568	481	326			
Shut-off PSI:												362	354	345	336	328	319	302	276	250	224	189	146	103	59		
10S30-34	3	0																826	790	751	711	655	577	471	289		
		20														833	822	799	761	720	679	620	534	400	159		
		30													832	820	809	784	745	704	662	602	509	357	79		
		40											840	830	819	807	795	770	730	688	646	583	481	308			
		50										839	828	817	805	793	781	755	714	672	629	563	449	250			
		60										826	815	803	791	779	766	739	698	656	611	541	413	184			
Shut-off PSI:												332	324	315	306	298	289	272	246	220	194	159	116	73	29		

10.2) FLO-ET, FLOW CONTROL

CLACK
MODEL # P-125-2, (1) 5 GPM BLUE INSERT, (1) 10 GPM ORANGE INSERT

FLO-ET FLOW CONTROLS



REDUCE WATER CONSUMPTION, INCREASE SAVINGS

Clack offers a full line of Flo-et® flow controls that provide an easy, efficient way to reduce water usage, water waste, and energy consumption in a wide range of liquid handling systems.

With every increase in energy costs, Flo-et flow controls offer increased cost efficiency.

These simple to install units can precisely control liquid flow rates from 1/4 gpm to 540 gpm, between 30 and 120 psi. They are ideal for applications that require tamper-proof volume regulation and pressure equalization.

Flo-et inserts are constructed of corrosion-resistant, molded material for maximum dependability and minimum maintenance to fit most flow regulation needs. And, this durable material complies with existing FDA regulations for food handling applications.

For residential, commercial, or industrial applications, Flo-et flow controls provide more accurate, reliable and economical liquid flow control.

Clack Corporation

FLO-ET FLOW CONTROLS

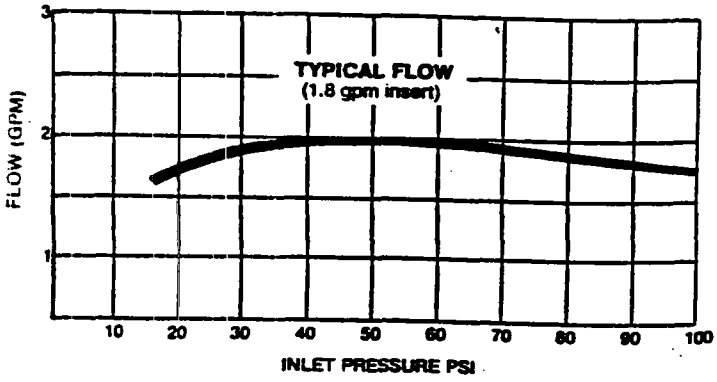
Clack Flo-et flow controls offer many advantages over conventional valve-type flow controls.

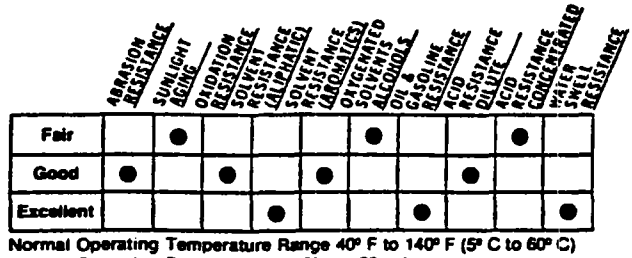
Initially, Flo-et controls cost less to install. And, because they require no maintenance or adjustments, they maximize cost savings over the life of your equipment.

Flo-et flow controls are completely tamper-proof, yet authorized persons can easily alter them for increases or decreases in the flow rate.

Clack offers a wide range of customized Flo-et inserts to meet your exact application needs. Both Flo-et inserts and retainers are ideal for incorporation into custom-designed housings. This provides additional cost savings by eliminating the need to purchase the brass housing. Because of our unique design Clack can offer you the option to purchase only the Flo-et insert or the insert and retainer.

SPECIFICATIONS

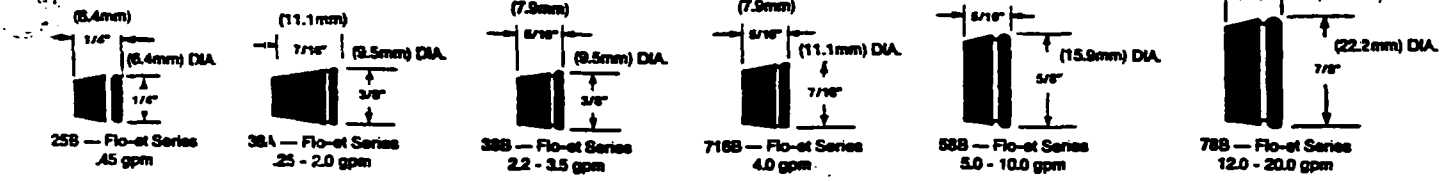




Normal Operating Temperature Range 40° F to 140° F (5° C to 60° C)
Normal Operating Pressure Range 20 to 120 psi
(1.4 - 8.4 Kg. per Sq. Cm.)

CHEMICAL RESISTANCE CHART (58B & 78B Series Inserts)

INSERTS



25B — Flo-et Series .45 gpm

38A — Flo-et Series .25 - 2.0 gpm

38B — Flo-et Series 2.2 - 3.5 gpm

716B — Flo-et Series 4.0 gpm

58B — Flo-et Series 5.0 - 10.0 gpm

78B — Flo-et Series 12.0 - 20.0 gpm

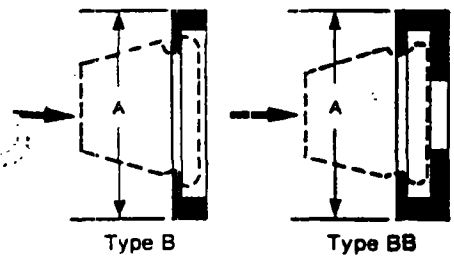
Order No.	Description	
V7B12B.45	#25B4-52	0.45 gpm
V7B21A.25	#38A3-47	0.25 gpm
V7B21A0.3	#38A3-57	0.30 gpm
V7B21A0.4	#38A4-47	0.40 gpm
V7B21A0.5	#38A4-57	0.50 gpm
V7B21A0.6	#38A5-46	0.60 gpm
V7B21A0.7	#38A5-47	0.70 gpm
V7B21A0.8	#38A5-57	0.80 gpm
V7B21A0.9	#38A6-47	0.90 gpm
V7B21A1.0	#38A6-57	1.0 gpm
V7B21A1.2	#38A7-47	1.2 gpm

Order No.	Description	
V7B21A1.4	#38A7-52	1.4 gpm
V7B21A1.6	#38A8-47	1.6 gpm
V7B21A1.8	#38A8-52	1.8 gpm
V7B21A2.0	#38A8-57	2.0 gpm
V7B22A2.2	#38B9-52	2.2 gpm
V7B22B2.5	#38B9-57	2.5 gpm
V7B22A2.6	#38B10-52	2.6 gpm
V7B22B3.0	#38B10-57	3.0 gpm
V7B22A3.5	#38B10-623	3.5 gpm

Order No.	Description	
V7B42A4.0	#716B11-623	4.0 gpm
V7B62B5.0	#58B13-535	5.0 gpm
V7B62B6.0	#58B14-568	6.0 gpm
V7B62B7.0	#58B15-568	7.0 gpm
V7B62B8.0	#58B16-568	8.0 gpm
V7B62B9.0	#58B16-602	9.0 gpm
V7B62B10	#58B17-602	10 gpm
V7B82B12	#78B20-58	12 gpm
V7B82B15	#78B21-62	15 gpm
V7B82B17	#78B23-62	17 gpm
V7B82B20	#78B24-74	20 gpm

Note: Special flow rates can be designed upon request.

RETAINERS



Type B retainer

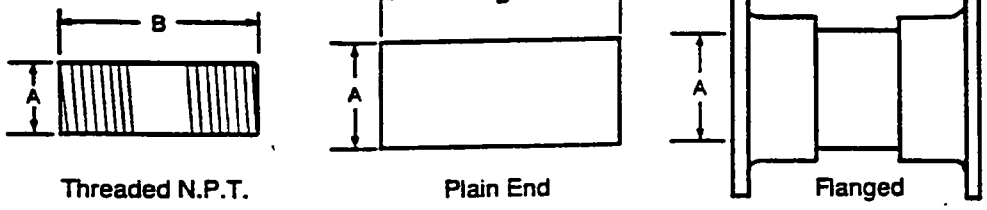
Type BB retainer

Type B retainer is intended for a press fit into an adapter that provides back-up support for the Flo-et insert. The BB type can be used in an adapter that does not provide back-up support.

Order No.	Description	"A" Dimension Inches	"A" Dimension Millimeters	For Insert Series No.
V7C12B1	#25R-1BB Retainer	.301 - .303	7.6 - 7.7	25B
V7C21B3	#38R-1B Retainer	.463 - .465	11.7 - 11.8	38A & 38B
V7C22B3	#38R-1BB Retainer	.463 - .465	11.7 - 11.8	38A & 38B
V7C21B5	#38R-2B Retainer	.525 - .527	13.3 - 13.4	38A & 38B
V7C22B6	#38R-4BB Retainer	.787 - .789	20.0 - 20.1	38A & 38B
V7C41B5	#716R-1B Retainer	.525 - .527	13.3 - 13.4	716B
V7C42B6	#716R-2BB Retainer	.787 - .789	20.0 - 20.1	716B
V7C62B6	#58R-2BB Retainer	.787 - .789	20.0 - 20.1	58B
V7C62B8	#58R-4BB Retainer	.995 - .997	25.2 - 25.3	58B
V7C82B8	#78R-2BB Retainer	.995 - .997	25.2 - 25.3	78B

PVC FLO-ET FLOW CONTROLS

Clack PVC flow controls are designed for applications where constant flow rates are required and variable pressures are encountered. They are ideal for use in environments where metal housings are not recommended, such as high purity, deionized water applications. Flow capacities are available from 1/4 gpm to 540 gpm.



Threaded N.P.T. | Plain End | Flanged

FLOW RATE GPM (1)	NO. OF INSERTS (2)	PIPE SIZE "A"	THREADED N.P.T.			PLAIN END			FLANGED		
			MODEL NO.	LENGTH "B" (INCHES)	APPROX. WEIGHT LBS.	MODEL NO.	LENGTH "B" (INCHES)	APROX. WEIGHT LBS.	MODEL NO.	LENGTH "B" (INCHES)	APPROX. WEIGHT LBS.
0.25-3.5	1	1/2	T-050-1	2	0.05	P-050-1	5	0.09	F-050-1	5	0.49
0.25-10	1	3/4	T-075-1	2	0.06	P-075-1	5	0.12	F-075-1	5	0.68
5-20	1	1	T-100-1	3	0.12	P-100-1	5	0.18	F-100-1	6	0.96
10-20	2	1-1/4	T-125-2	3	0.18	P-125-2	5	0.27	F-125-2	6	1.27
20-40	4	1-1/2	T-150-4	3	0.25	P-150-4	5	0.36	F-150-4	6	1.64
35-70	7	2	T-200-7	3	0.31	P-200-7	5	0.47	F-200-7	6	2.43
45-90	9	2-1/2	T-250-9	4	0.56	P-250-9	5	0.80	F-250-9	6	3.80
70-140	14	3	T-300-14	4	0.68	P-300-14	5	1.00	F-300-14	6	4.76
120-250	25	4	T-400-25	4	1.00	P-400-25	5	1.47	F-400-25	6	7.55
270-540	54	6	T-600-54	4	2.50	P-600-54	8	3.90	F-600-54	8-1/2	12.60

TABLE A
Inserts 0.25 to 3.5 GPM
Not color coded (Black)

0.25 GPM	1.60 GPM
0.30 GPM	1.80 GPM
0.40 GPM	2.00 GPM
0.70 GPM	2.20 GPM
0.80 GPM	2.50 GPM*
0.90 GPM	2.60 GPM
1.20 GPM	3.00 GPM
1.40 GPM	3.50 GPM

*2.50 GPM available in brown on special request

TABLE B
Color Identification of BUNA (N) Inserts

5 GPM — Blue
6 GPM — Red
7 GPM — Brown
8 GPM — Green
9 GPM — Tan
10 GPM — Orange

Clack Corporation

4462 Duraform Lane P.O. Box 500
Windsor, Wisconsin 53598-0500 USA

Phone (608) 846-3010 • Fax No. (608) 846-2586
Sales/Customer Service Fax (800) 755-3010

RESIDENTIAL AND LIGHT COMMERCIAL

Clack offers a wide range of Flo-et flow controls that are ideal for use in private homes and buildings. Water flow rate can be equalized throughout the home or building by installing a Flo-et at the inlet to each appliance. And, water usage can be reduced substantially by controlling the volume of water used in sinks, showers, and drinking fountains.

Flo-et flow controls can be incorporated into in-line housings for specific contact time with point-of-use water filters.

Residential and light commercial Flo-et flow controls are available in flow rates from 1/4 to 20 gpm.

FLO-ET FLOW CONTROLS

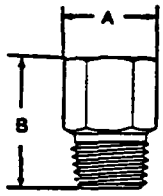


Fig. 1

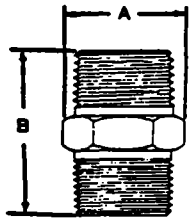


Fig. 2

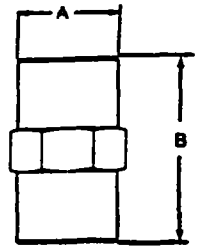


Fig. 3

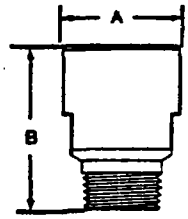


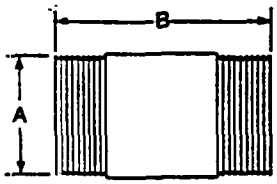
Fig. 4

Order No.	Description	Available Flow Rates	Pipe Size	A In. (mm)	B In. (mm)	Flow Direction	Housing Material	Figure
V7A033B1	#77-19 3/8" B Flo-Control	.25 - 3.5 gpm	3/8"	3/4" Hex (19.1mm)	1-1/4" (31.8mm)	F—M, M—F	Brass	1
V7A036B5	#80-23 3/8" P Flo-Control	.25 - 4.0 gpm	3/8"	13/16" Hex (20.8mm)	1-1/2" (38.1mm)	F—F	Nickel-Chrome, Plated Brass	3
V7A052B5	Hydro Saver 1/2" NPT	2.5 - 3.0 gpm	1/2"	1" Dia. (25.4mm)	1-1/2" (38.1mm)	F—M	Polished Nickel Chrome Plated Brass	4
V7A053B1	#70-CN3 1/2" B Flo-Control	.25 - 4.0 gpm	1/2"	1" Hex (25.4mm)	1-1/4" (31.8mm)	F—M, M—F	Brass	1
V7A053C1	#76-1A 1/2" PVC Flo-Control	.25 - 3.5 gpm	1/2"	1-1/2" Dia. (38.1mm)	1-3/4" (44.5mm)	F—M, M—F	Type 1, Grade P.V.C.	4
V7A056B5A	#83-46A 1/2" P Flo-Control	.25 - 4.0 gpm	1/2"	1" Hex (25.4mm)	1-7/8" (47.6mm)	F—F	Nickel-Chrome, Plated Brass	3
V7A056B5B	#83-46B 1/2" P Flo-Control	5.0 - 10.0 gpm	1/2"	1" Hex (25.4mm)	1-7/8" (47.6mm)	F—F	Nickel-Chrome, Plated Brass	3
V7A071B1	#70-CN25 3/4" B Flo-Control	.25 - 10.0 gpm	3/4"	1-3/32" Hex (27.8mm)	1-3/4" (44.5mm)	M—M	Brass	2
V7A076B5	#78-111 3/4" P Flo-Control	.25 - 10.0 gpm	3/4"	1-1/4" Hex (31.8mm)	2" (50.8mm)	F—F	Nickel-Chrome, Plated Brass	3
V7A101B1	#77-4 1" B Flo-Control	5.0 - 20.0 gpm	1"	1-3/8" Hex (34.9mm)	2-1/4" (57.2mm)	M—M	Brass	2
V7A106B5	#78-103 1" P Flo-Control	5.0 - 20.0 gpm	1"	1-1/2" Hex (38.1mm)	2-3/4" (69.9mm)	F—F	Nickel-Chrome, Plated Brass	3

COMMERCIAL/INDUSTRIAL

Clack Commercial/Industrial Flo-ets provide flow control in a variety of applications, including multi-story buildings, water treatment equipment, cooling towers, and agricultural irrigation systems.

These highly efficient flow controls are available in flow rates from 1/4 gpm to 280 gpm. The body of the Commercial/Industrial Flo-et is a steel nipple* with sizes from 3/4 inch to 6 inches in diameter.



ORDER NUMBER	A		B		APPROX. WEIGHT		STATE FLOW WHEN ORDERING		NO. OF FLO-ETS
	N.P.T. U.S. INCHES	CENTI-METERS	U.S. INCHES	CENTI-METERS	U.S. LBS.	KILOGRAM	U.S. GALLONS PER/MIN.	LITERS PER/MIN.	EACH
V7A071B1*	3/4"	1.90	1-3/4"	4.4	3 oz.	.08 Kg	0.25-10	.95-38	1
V7A101B1*	1"	2.54	2-1/4"	5.7	6 oz.	.17 Kg	5-20	17-76	1
V7A201A2	2"	5.08	4"	10.2	1.5 lbs.	.68 Kg	15-30	57-114	3
V7A301A2	3"	7.62	4-1/2"	11.4	2.75 lbs.	1.25 Kg	30-70	114-265	7
V7A401A2	4"	10.16	5"	12.7	4.75 lbs.	2.15 Kg	60-120	227-454	12
V7A501A2	5"	12.70	5"	12.7	6 lbs.	2.72 Kg	70-190	265-719	19
V7A601A2	6"	15.24	5-1/2"	14.0	8.75 lbs.	3.97 Kg	140-280	530-1060	28

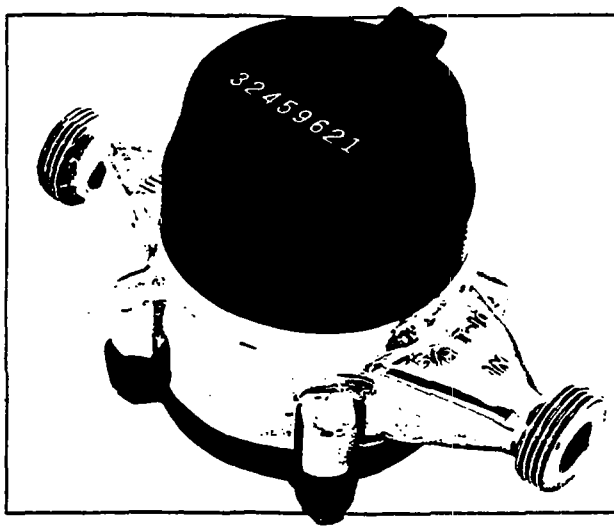
*On 3/4" N.P.T. and 1" N.P.T. body material is brass.

10.3) FLOW METER

SCHUMBERGER
MODEL # NEPTUNE T-10, 3/4" DIA.

Schlumberger

Water Division



Neptune® T-10®

Water Meter
Sizes: 5/8", 3/4", & 1"

Features and Benefits

Roll-Sealed Register
- Magnetic drive, low torque registration ensures accuracy
- New impact resistant register design with flat glass for legibility
- 1:1 Ratio, low flow indicator detects leaks
- Bayonet mount allows in-line serviceability
- Tamperproof seal pin deters theft
- Date of manufacture, size, and model stamped on dial face

Cast Bronze Maincase
- Sturdy, durable corrosion resistant
- Resists internal pressure stresses and external damage
- Handles in-line piping variations and stresses
- Residual value

Nutating Disc Measuring Chamber
- Positive displacement
- Widest effective flow range for greater utility revenue
- Extended low flow accuracy
- Corrosion resistant
- Floating chamber design is unaffected by meter position or in-line piping stress

Systems Compatibility
- Adaptability to all Neptune Systems provides flexibility

Performance

Every Neptune T-10 water meter meets or exceeds the latest AWWA Standard, C700-90. Its nutating disc, positive displacement principle is time proven for accuracy and dependability since 1892, ensuring maximum utility revenue.

Construction

The Neptune T-10 water meter consists of three major assemblies: a roll-sealed register, a cast bronze maincase, and a nutating disc measuring chamber.

The roll-sealed register eliminates lens fogging, uses naturally lubricated, molded gears, and contains a low flow indicator for leak detection. For reading convenience, the register can be mounted in any one of four positions on the meter. All T-10 water meters can accommodate standard registers or remote reading registers for the Neptune ARB® (Automatic Reading and Billing) System, Pulser-RM visual remote system, and Tricon™/S and Tricon/E systems.

The corrosion-resistant cast bronze maincase will withstand most service conditions: internal water pressure, rough handling, and in-line piping stress. For frost protection, synthetic polymer or cast iron bottom caps are available.

The innovative floating chamber design of the nutating disc measuring element protects the chamber from frost damage while the unique chamber seal extends the low flow accuracy by bonding the chamber outlet port to the maincase outlet port. The nutating disc measuring element utilizes corrosion resistant materials throughout and a thrust roller to minimize wear.

Warranty and Maintenance

Neptune T-10 water meters are warranted by Schlumberger for performance, materials, and workmanship. Schlumberger further offers an optional post-warranty factory "Revenue Asset Maintenance" (RAM) program for extended service life.

When desired, owner maintenance is easily accomplished either by unitized replacement of major components or by repair of an individual component's parts.

Guaranteed Systems Compatibility

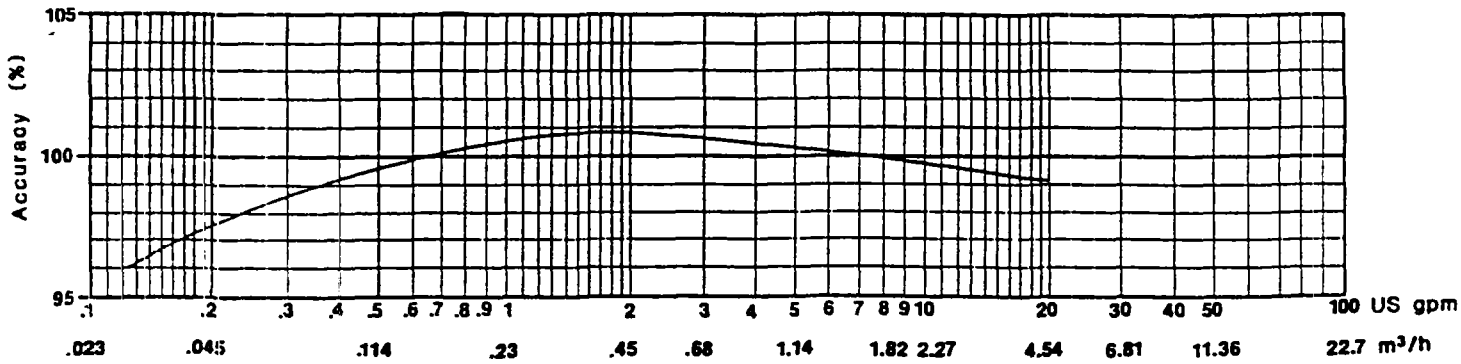
All Neptune T-10 meters are guaranteed adaptable to Pulser-RM, ARB®, ARB® ProRead™, CMR®, Tricon/S, Tricon/E, NMR, and Unigun™ Systems without removing the meter from service.

Schlumberger

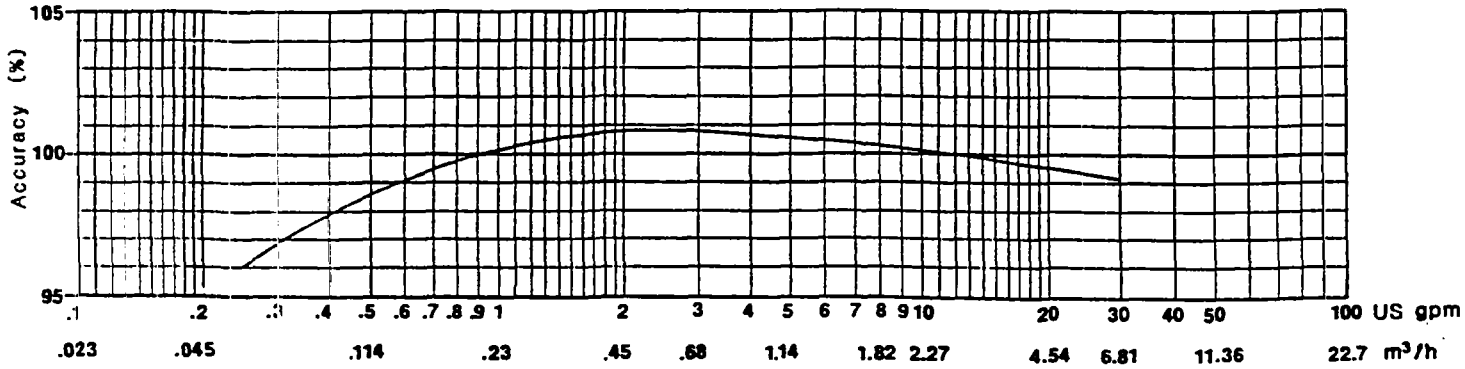
Water Division

5/8", 3/4" & 1"
NEPTUNE T-10 ACCURACY

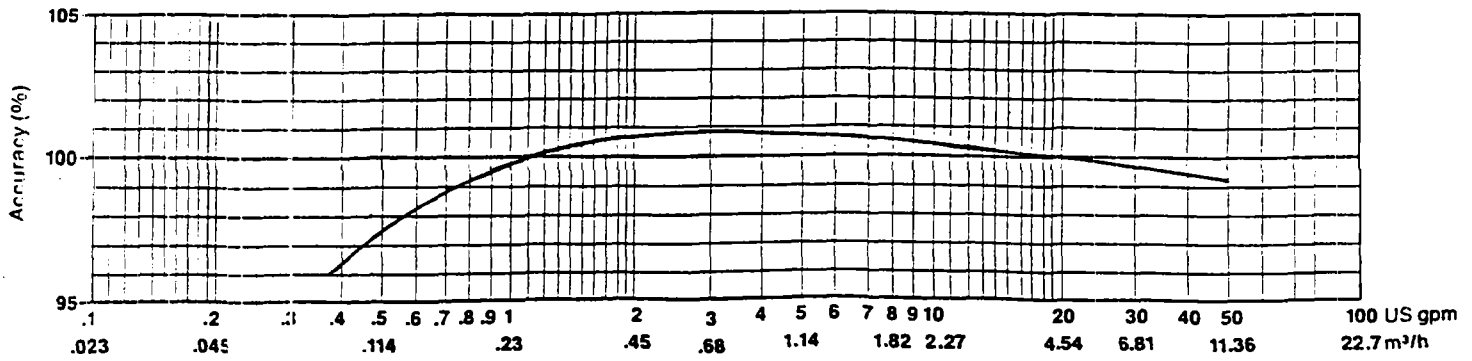
5/8"



3/4"



1"

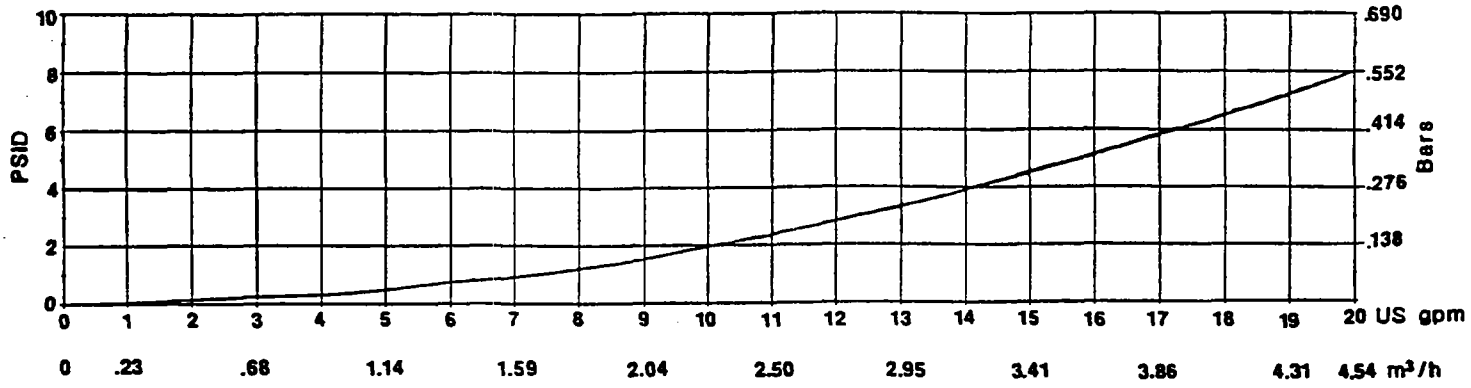


Schlumberger

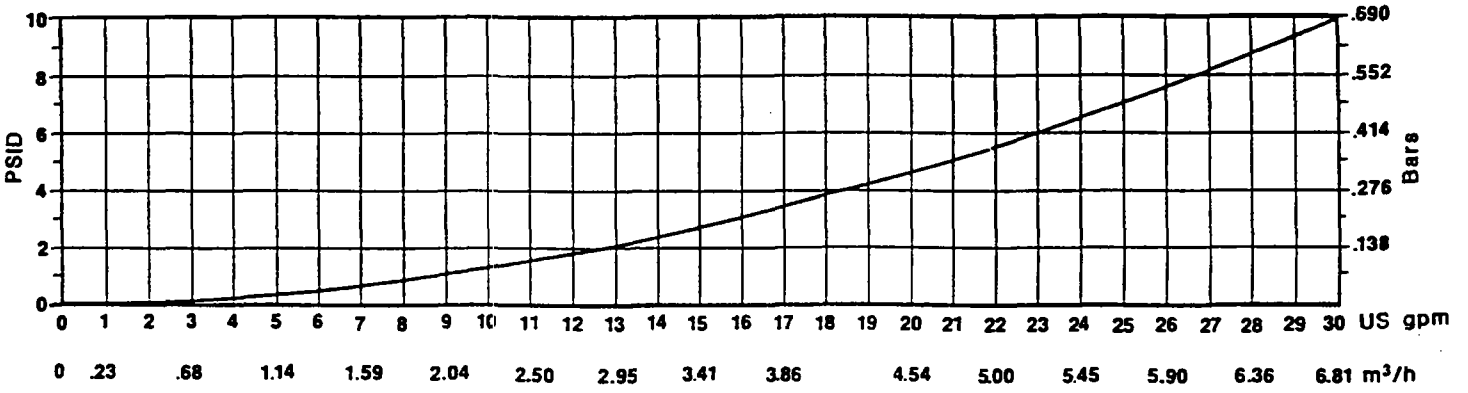
Water Division

5/8", 3/4" & 1"
NEPTUNE T-10 PRESSURE LOSS

5/8"



3/4"



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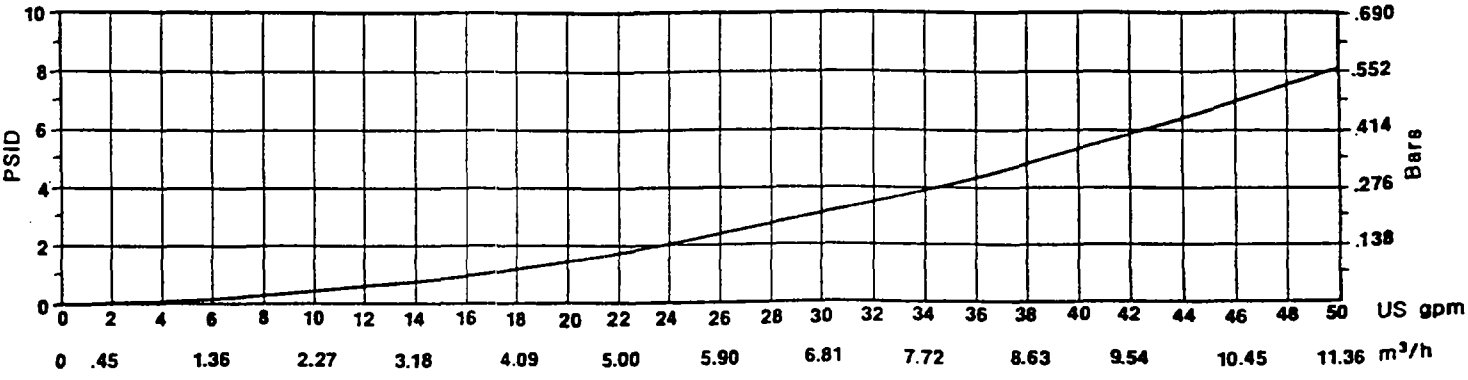


Schlumberger

Water Division

Specifications

Application
Cold water measurement of flow in one direction

Maximum Operating Pressure
150 psi (1034 kPa)

Register
Direct reading, center sweep, roll-sealed, magnetic drive, with low flow indicator

Measuring Chamber
Nutating Disc, synthetic polymer

Options

Sizes
5/8", 5/8" x 3/4"
3/4", 3/4" SL, 3/4" x 1"
1", 1" x 1 1/4"

Units of Measure
U.S. Gallons
Imperial Gallons
Cubic Feet
Cubic Metres

Register Types
Direct Reading:
- Synthetic polymer box and cover
- Bronze box and cover

Remote Reading:
- ARB, ARB ProRead
- Pulser-RM
- Tricon/S
- Tricon/E

Bottom Caps
Synthetic polymer (5/8" only)
Cast Iron
Bronze

Connections
Bronze, straight or bent

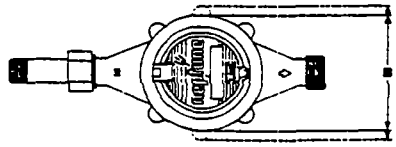
Operating Characteristics

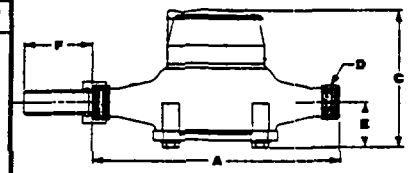
Meter Size	Normal Operating Range @ 100% Accuracy ± 1.5%)	AWWA Standard	Low Flow @ 95% Accuracy
5/8"	1/2 to 20 US gpm 0.11 to 4.5 m^3/h	1 to 20 US gpm 0.23 to 4.5 m^3/h	1/8 US gpm 0.03 m^3/h
3/4"	3/4 to 30 US gpm 0.17 to 6.8 m^3/h	2 to 30 US gpm 0.45 to 6.8 m^3/h	1/4 US gpm 0.06 m^3/h
1"	1 to 50 US gpm 0.23 to 11.4 m^3/h	3 to 50 US gpm 0.68 to 11.4 m^3/h	3/8 US gpm 0.09 m^3/h

Registration

Registration (per sweep hand revolution):			
		5/8"	3/4" & 1"
10	US Gallons	✓	✓
10	Imperial Gallons	✓	✓
1	Cubic Feet	✓	✓
0.1	Cubic Metres	✓	✓
0.01	Cubic Metres	✓	

Register (6-wheel odometer):			
		5/8"	3/4" & 1"
10,000,000	US Gallons	✓	✓
10,000,000	Imperial Gallons	✓	✓
1,000,000	Cubic Feet	✓	✓
100,000	Cubic Metres	✓	✓
10,000	Cubic Metres	✓	





Dimensions

Meter Size	A in/mm	B in/mm	C Std in/mm	C ARB in/mm	C Pul in/mm	D Threads per inch	D OD in/mm	E in/mm	F in/mm	Approx Weight lbs/kg
5/8"	7 1/2 191	3 5/8 92	4 7/8 124	5 3/8 137	6 3/4 171	14	1.030 26	1 5/8 41	2 1/2 64	3 3/4 1.7
5/8" x 3/4"	7 1/2 191	3 5/8 92	4 7/8 124	5 3/8 137	6 3/4 171	11 1/2	1.290 33	1 5/8 41	2 5/8 67	4 1.8
3/4"	9 229	4 3/8 111	5 1/2 140	5 13/16 148	7 3/8 187	11 1/2	1.290 33	1 7/8 48	2 5/8 67	6 2.7
3/4" SL	7 1/2 191	4 3/8 111	5 1/2 140	5 13/16 148	7 3/8 187	11 1/2	1.290 33	1 7/8 48	2 5/8 67	5 1/2 2.5
3/4" x 1"	9 229	4 3/8 111	5 1/2 140	5 13/16 148	7 3/8 187	11 1/2	1.626 41	1 7/8 48	2 3/4 70	6 1/2 2.9
1"	10 3/4 273	6 1/2 165	6 3/8 162	6 5/8 168	8 3/16 208	11 1/2	1.626 41	2 1/8 54	2 3/4 70	9 3/4 4.4
1" x 1 1/4"	10 3/4 273	6 1/2 165	6 3/8 162	6 5/8 168	8 3/16 208	11 1/2	1.865 47	2 1/8 54	2 13/16 71	10 1/4 4.6

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10.4) ROSEDALE FILTER

ROSEDALE SOCK FILTER
MODEL # 8-15-2P-1-150-C-B-S-B

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

ROSEDALE PRODUCTS, INC.

MODEL 8

150 PSIG RATED FILTER UNIT

Table of Contents

I. Installation

Please remove all shipping and crating materials carefully. Be sure to remove the plugs from the inlet and outlet openings. Dispose of all crating materials safely.

The Model 8 Filter unit is capable of having several different piping variations based upon the outlet style of your unit. The inlet service line should be connected to the inlet flange or NPT coupling located near the top of the unit (above the basket level).

The outlet service line should be connected to the outlet flange or coupling, located near the middle or bottom of the unit depending upon the style of your unit (below basket level).

There are two 1/4" NPT ports on the shell and one 1/4" NPT port on the cover of the Model 8 Filter unit. These ports can remain plugged or used for pressure gauges or special fittings as your application requires.

Some installations require electrical grounding of all equipment, be sure to provide adequate grounding where necessary.

After completing installation be sure to double check connections for integrity. Your Model 8 Filter unit has been factory pressure tested leak free, therefore, any seepage problems usually occur from improper installation connections.

You are now ready to install the filter basket and bag. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.

If your application requires a basket seal, insert the basket seal into the basket collar groove. Refer to Figure 1 or Figure 2 in the Spare Parts Diagram for installation position of your seal.

Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar.

Insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.

Before replacing cover assembly, inspect cover seal gasket (replacing as necessary). Close cover and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between the cover and housing body. The recommended torque value for 5/8"-11 closure assemblies is $150^{\text{inch-lbs}}$.

Your Rosedale Model 8 is now ready for operation!

II. Operation

Filter System Start-Up Procedure:

Prior to turning on the flow to the inlet service, please make the following checks:

1. Check inside filter unit to be sure basket and filter bag (if applicable) are in housing and do not require cleaning or replacement. If necessary install a clean filter basket and bag (if applicable).

2. Check that filter unit cover is securely fastened to housing. You are now ready to open the flow to the inlet service line. Slowly open the inlet service line approximately 25% of normal operational flow (open slowly as not to displace filter bag inside the housing). After filter unit is pressurized and vented, slowly open outlet service line unit valve until completely open. Complete opening of inlet service line until desired flow rate is reached.

Once the desired service flow has been established, the filter will operate efficiently until dirty. However, under no circumstances should more than *15 PSI Differential Pressure* through the filter be obtained. Operating the filter unit with a high differential may cause filter bags to rupture and/or cause damage to filter system and downstream equipment.

To prevent excessive drop through the filter unit, regular inspection of the filter media is required. Monitoring of differential pressure through the housing can be utilized as a means of determining whether or not the filter media needs cleaning or replacement.

When it becomes necessary to clean or replace filter media, follow the procedure outlined below:

1. First close the flow from the inlet service line.
2. Close the flow to the outlet service line. (In some applications closing flow to outlet is not required.)
3. Relieve the pressure from the filter unit.

⚠ WARNING

CONTENTS UNDER PRESSURE
Relieve Pressure in accordance with Manufacturer's instructions before opening Filter Vessel.
FAILURE TO DO SO MAY RESULT IN SERIOUS BODILY INJURY.

4. Drain housing sufficiently to access filter basket.
5. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.
6. Remove filter basket and clean thoroughly, remove the filter bag (if applicable) and throw

away. (Cleaning and reusing the filter bag is not recommended.)

7. Remove debris and sludge from inside the inlet portion of housing to avoid interference with cover seal or flow of fluid being filtered.
8. Remove basket seal and inspect, replace if necessary. Clean basket seal groove and replace basket seal (see spare parts diagram for location of basket seal).
9. Install clean filter basket and filter bag (if applicable). Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar. If applicable, insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.
10. Inspect cover gasket for cuts or other signs of failure and make sure it is properly seated.
11. Move cover back into position, and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between cover and housing body. The recommended torque value for 5/8"-11 closure assemblies is 150 inch-lbs.

Your Rosedale Model 8 Filter unit is now ready for operation. Refer to filter system start-up procedure.

III. Spare Parts List

Your Rosedale Model 8 Filter unit will give you many years of reliable service provided periodic inspections are made of various components and replacement of worn parts are made promptly. The following is meant to be a recommended spare parts list, these parts are illustrated on the following page.

SPARE PARTS LIST			
Balloon	Description	Part Number	Time-Frame
1	Cover Seal	8150CG-*	as needed
2	Basket Seal	8BG-*	as needed
3	Cover	8*150	as needed
4	Eye Nut	8ENNI	as needed
5	Rod End	8RENI	as needed
6	Clevis Pin Assembly	8CPNI	as needed
7	Filter Bag	(See Order)	as needed
8	Filter Basket	(See Order)	as needed
9	Tripod Legs	8T22*S	as needed

* Select Material Designation:

C=Carbon Steel
S=304 Stainless Steel
S316=316 Stainless Steel

B=Buna N
E=Ethylene Propylene
V=Viton
TEV=Teflon Encapsulated Viton
TSW=Teflon Solid White

IV. Spare Parts Diagram

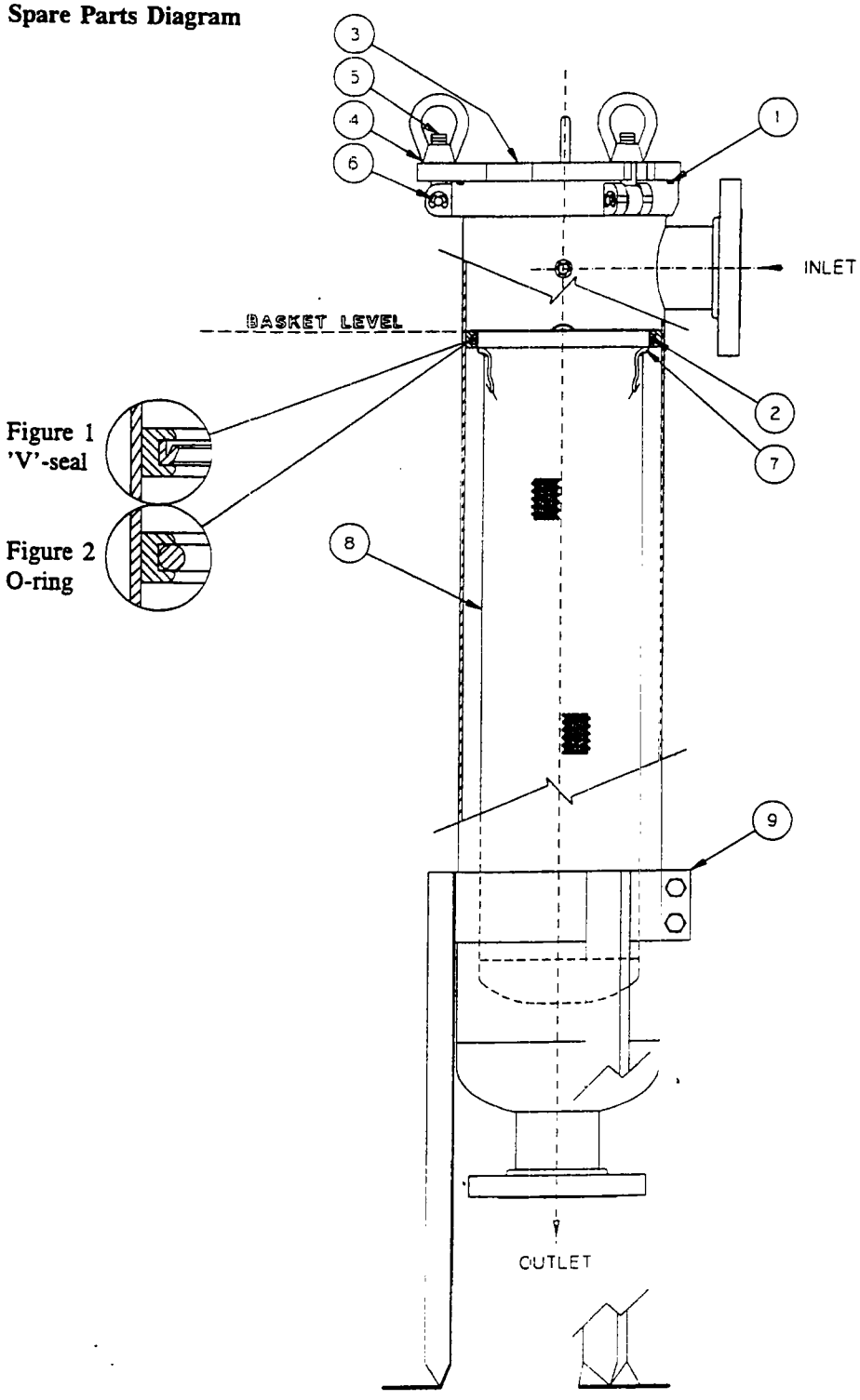


Figure 1
'V'-seal

Figure 2
O-ring

Important Notice

Warranty: In the event any Rosedale Products, Inc. filtration product is found to be defective in material, workmanship, or not in conformance with any express warranty for a specific purpose, Rosedale's only obligation and your exclusive remedy, shall be to repair, replace or refund the purchase price of such parts or products upon timely notification thereof and substantiation that the product has been stored, maintained and used in accordance with Rosedale's written instructions.

EXCLUSIONS TO WARRANTY: **THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, EXCEPT OF TITLE AND AGAINST PATENT INFRINGEMENT.**

LIMITATION OF LIABILITY: Except as provided above, Rosedale shall not be liable or responsible for any loss or damage, whether direct, indirect, incidental, special or consequential, arising out of sale, use or misuse of Rosedale filtration products, or the user's inability to use such products.

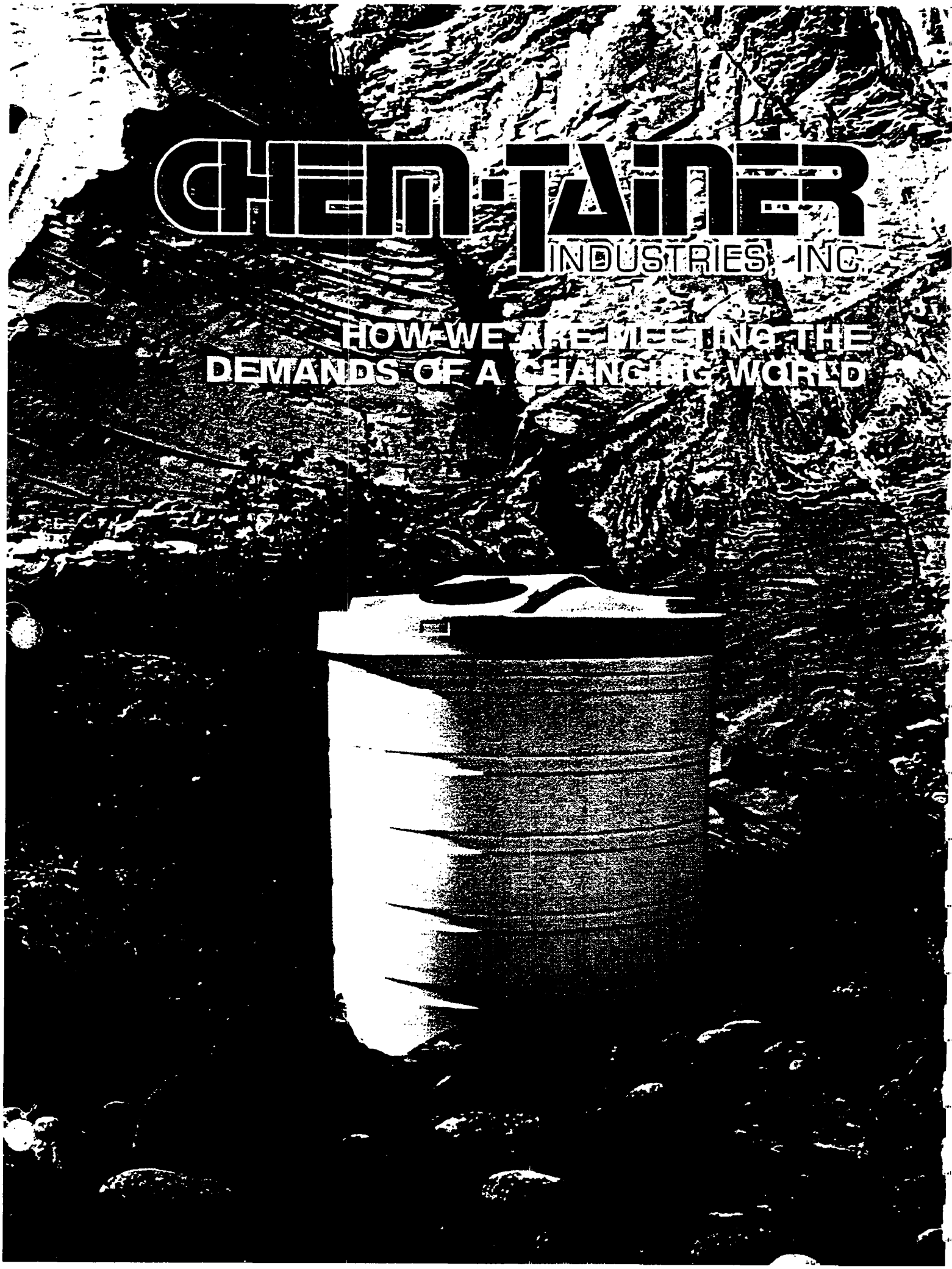
THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

Rosedale Products, Inc.
3730 West Liberty Road
Ann Arbor, MI 48103 USA
313-665-8201
800-821-5373
Fax. 313-665-2214
Filters@mcimail.com
http://www.webcom.com/ – filters/

10.5) HOLDING TANK

CHEM-TAINER POLYETHYLENE TANK
MODEL # TC3060AA

CHEM-TAINER POLYETHYLENE LID
MODEL # TC3060AF


CHEM-TAINER
INDUSTRIES, INC.
HOW WE ARE MEETING THE
DEMANDS OF A CHANGING WORLD

Open Top Flat Bottom Cylindrical Tanks

One piece molded heavy walled tanks designed to withstand rugged service. Ideal for handling acids and caustics.

• Resin complies with U.S. Food and Drug Administration regulation 21 CFR 177.1520 (c) 3.1 and 3.2. See page 43 for more information.

AA Series – Linear Polyethylene (PE) – • Excellent chemical and impact resistance for long dependable service. • Operating temperatures up to 140° F. • Open top allows convenient mixing and filling. • Self-supporting • Translucent* for visible content level.

AB Series – Polypropylene (PP) – • Excellent chemical and stress cracking resistance. • Operating temperature up to 212° F. • Self supporting. • Not recommended for cold temperatures or high impact applications.

AK – AM Series – Steel Stands – • Heavy duty stands with corrosion resistant coating. • Floor mounted agitators available see page 15. • **Available in stainless steel.**

AF Series – Covers – • One piece molded polyethylene construction.

AH Series – Hinged Covers – • Molded polyethylene construction. • Flexible polypropylene hinge with stainless steel rivets.

FH Series – Hinged Covers – • All polyethylene construction. • Heavy duty fabricated covers.

• Pre-engineered tank and mixer packages on pages 14-15.

See price sheet for AF, AH & FH cover part #'s.

*The degree of translucency varies with wall thickness and tank color.

CAPACITY (GAL)	DIA. X HT. (IN.)	WALL APPR. (IN.)	AA PE TANK PART #	AB PP TANK PART #	AK STAND PART #	AM STAND PART #	FOB (3) POINTS
5	11 x 13 †	3/16	TC1113AA	TC1113AB	TC1113AK	TC1113AM	NTICFP,Tn
7	10 x 21 †	3/16	TC1021AA	TC1021AB	TC1021AK	TC1021AM	NTICFP,Tn
7.5	12 x 18 †	3/16	TC1218AA	TC1218AB	TC1218AK	TC1218AM	NTICFP,Tn
8	13 x 16 †	3/16	TC1316AA	TC1316AB	TC1316AK	TC1316AM	NTICFP,Tn
10	13 x 21 †	3/16	TC1321AA	TC1321AB	TC1321AK	TC1321AM	NTICFP,Tn
12	15 x 16 †	3/16	TC1516AA	TC1516AB	TC1516AK	TC1516AM	NTICFP,Tn
15	15 x 19 †	3/16	TC1519AA	TC1519AB	TC1519AK	TC1519AM	NTICFP,Tn
16	14 x 27 †	3/16	TC1427AA	TC1427AB	TC1427AK	TC1427AM	NTICFP,Tn
16	15 x 22 †	3/16	TC1522AA	TC1522AB	TC1522AK	TC1522AM	NTICFP,Tn
17	18 x 15 †	3/16	TC1815AA	TC1815AB	TC1815AK	TC1815AM	NTICFP,Tn
25	14 x 40 †	3/16	TC1440AA	TC1440AB	TC1440AK	TC1440AM	NTICFP,Tn
28	22 x 18 †	3/16	TC2218AA	TC2218AB	TC2218AK	TC2218AM	NTICFP,Tn
30	18 x 29 †	1/4	TC1829AA	TC1829AB	TC1829AK	TC1829AM	NTICFP,Tn
36	15 x 48 †	1/4	TC1548AA	TC1548AB	TC1548AK	TC1548AM	NTICFP,Tn
40	18 x 40 †	1/4	TC1840AA	TC1840AB	TC1840AK	TC1840AM	NTICFP,Tn
55	22 x 36 †	1/4	TC2236AA	TC2236AB	TC2236AK	TC2236AM	NTICFP,Tn
65	22 x 40 †	1/4	TC2240AA	TC2240AB	TC2240AK	TC2240AM	NTICFP,Tn
70	24 x 36 †	5/16	TC2436AA	TC2436AB	TC2436AK	TC2436AM	NTICFP,Tn
73	30 x 24 †	5/16	TC3024AA	TC3024AB	TC3024AK	TC3024AM	NTICFP,Tn
85	28 x 32 †	5/16	TC2832AA	TC2832AB	TC2832AK	TC2832AM	NTICFP,Tn
90	30 x 30	5/16	TC3030AA	TC3030AB	TC3030AK	TC3030AM	N
90	24 x 48	5/16	TC2448AA	TC2448AB	TC2448AK	TC2448AM	NTICF
100	28 x 42	5/16	TC2842AA	TC2842AB	TC2842AK	TC2842AM	NTICFP,Tn
102	27 x 45	5/16	TC2745AA	TC2745AB	TC2745AK	TC2745AM	PC
105	36 x 24	5/16	TC3624AA	TC3624AB	TC3624AK	TC3624AM	N
105	24 x 54	5/16	TC2554AA	TC2554AB	TC2554AK	TC2554AM	NC
110	30 x 36	5/16	TC3036AA	TC3036AB	TC3036AK	TC3036AM	NTIC
125	36 x 30	5/16	TC3630AA	TC3630AB	TC3630AK	TC3630AM	N
150	31 x 48	5/16	TC3148AA	TC3148AB	TC3148AK	TC3148AM	NTICFP,Tn
155	36 x 36	5/16	TC3636AA	TC3636AB	TC3636AK	TC3636AM	P
165	31 x 56	5/16	TC3156AA	TC3156AB	TC3156AK	TC3156AM	P
180	30 x 60	5/16	TC3060AA	TC3060AB	TC3060AK	TC3060AM	N
200	36 x 48	5/16	TC3648AA	TC3648AB	TC3648AK	TC3648AM	NTICFP,Tn
260	36 x 60	5/16	TC3660AA	TC3660AB	TC3660AK	TC3660AM	NIC
260	39 x 53	5/16	TC3953AA	TC3953AB	TC3953AK	TC3953AM	P
275	42 x 48	5/16	TC4248AA	TC4248AB	TC4248AK	TC4248AM	NTICFP,Tn
315	48 x 42	3/8	TC4842AA	TC4842AB	TC4842AK	TC4842AM	T
325	36 x 74	3/8	TC3674AA	TC3674AB	TC3674AK	TC3674AM	N
330	45 x 48	3/8	TC4548AA	TC4548AB	TC4548AK	TC4548AM	NI
360	48 x 48	3/8	TC4848AA	TC4848AB	TC4848AK	TC4848AM	N
440	52 x 48	3/8	TC5248AA	TC5248AB	TC5248AK	TC5248AM	NTICFP,Tn
500	52 x 60	3/8	TC5260AA	TC5260AB	TC5260AK	TC5260AM	NIC
550	48 x 72	3/8	TC4872AA	TC4872AB	TC4872AK	TC4872AM	NTICPF,Tn
575	60 x 46	3/8	TC6046AA	• •	TC6046AK	TC6046AM	NIF
575	42 x 96	3/8	TC4296AA	• •	TC4296AK	TC4296AM	N
650	48 x 84	3/8	TC4884AA	• •	TC4884AK	TC4884AM	N
675	66 x 46	3/8	TC6646AA	• •	TC6646AK	TC6646AM	NF
700	55 x 70	3/8	TC5570AA	• •	TC5570AK	TC5570AM	NIC
800	72 x 46	3/8	TC7246AA	• •	TC7246AK	TC7246AM	N
800	60 x 66	3/8	TC6066AA	• •	TC6066AK	TC6066AM	N
950	78 x 46	3/8	TC7846AA	• •	TC7846AK	TC7846AM	N
1000	66 x 72	3/8	TC6672AA	• •	TC6672AK	TC6672AM	NIC
1000	84 x 46	3/8	TC8446AA	• •	TC8446AK	TC8446AM	NF
1100	60 x 90	7/16	TC6090AA	• •	TC6090AK	TC6090AM	N
1250	69 x 84	7/16	TC6984AA	• •	TC6984AK	TC6984AM	NIC
1350	82 x 59	7/16	TC8259AA	• •	TC8259AK	TC8259AM	N
1500	73 x 84	7/16	TC7384AA	• •	TC7384AK	TC7384AM	NI
1850	82 x 83	7/16	TC8283AA	• •	TC8283AK	TC8283AM	N
2000	84 x 84	7/16	TC8484AA	• •	TC8484AK	TC8484AM	NIC
2000	82 x 90	7/16	TC8290AA	• •	TC8290AK	TC8290AM	N
2975	95 x 97 (2)	1/2	TC9597AA	—	—	—	TICP,Tn
4250	120 x 87 (2)	1/2	TC4250AA	—	—	—	TICP,Tn
5700	120 x 117 (2)	5/8	TC5700AA	—	—	—	TICP,Tn
6400	120 x 131 (2)	5/8	TC6400AA	—	—	—	TICP,Tn

Stainless Steel tanks are available in capacities from 10 gallons to 5000 gallons in cylindrical, horizontal and rectangular configurations in both industrial and sanitary finishes. See page 28 for details.

(2) Internal flanges. (3) Subject to stocking inventory ** Available with FRP casing. † Within in UPS dimensional limits. See page 33.

FOB Codes: N=NY, T=TX, I=IL, C=CA, F=FL, P=PA, Tn=TN

How to select & order tanks, see page 33.

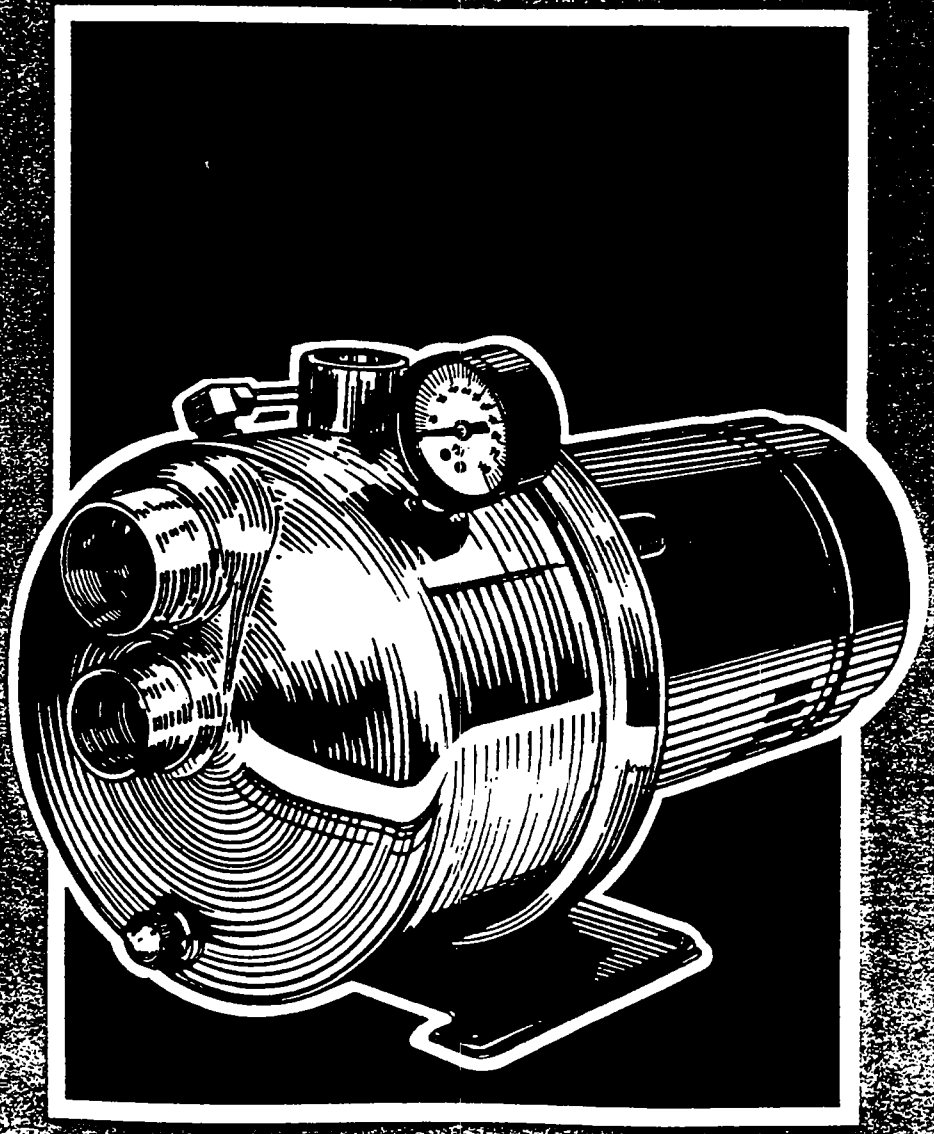
10.6) TRANSFER PUMP

GRUNDFOS, "JET STAR" STAINLESS STEEL CONVERTIBLE JET PUMP
MODEL # JP-5, 1/2 HP, SINGLE PHASE 115/230 VOLT

Installation and Operating Instructions

Grundfos Jet Star

GRUNDFOS®



Please leave these instructions with the pump

Installation and Operating Instructions

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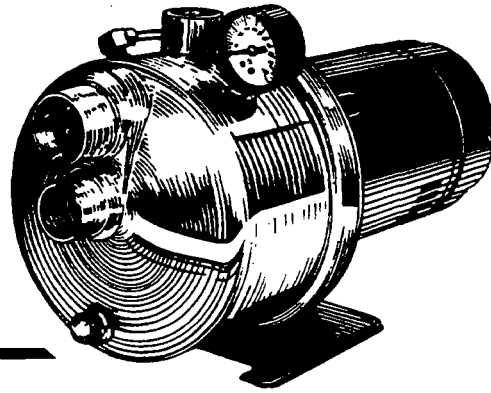
Installation and Operating Instructions

GRUNDFOS JET STAR



Your Grundfos Jet Star is of the utmost quality. Combined with a properly constructed installation, the Grundfos Jet Star will give you many years of reliable service.

To ensure the proper installation of the pump carefully read the complete manual before attempting to install the pump.

SECTION 1. Shipment Inspection

Examine the pump carefully to make sure damage has not occurred during shipment. If damage is detected, report it to your Grundfos Dealer. Prior to installation, the pump should remain in its carton to ensure protection.

SECTION 2. Pre-Installation

Before beginning the installation procedures, the following checks should be made:

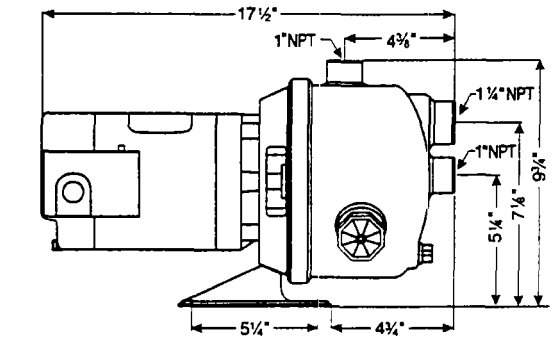
☑ **STATE AND LOCAL CODES:** Consult state and local sanitary codes on the proper equipment necessary to prevent contamination of your well. These codes are for your safety and protection.

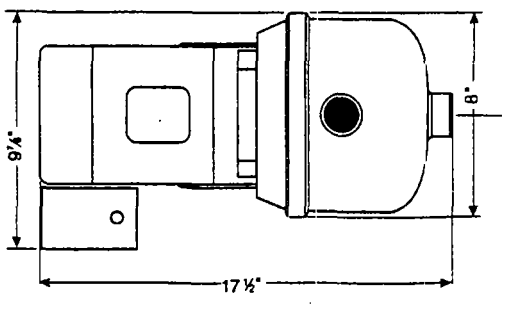
☑ **MOTOR VOLTAGE, PHASE AND FREQUENCY:** The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the available power supply. If the motor voltage does not correspond, a voltage change can be made in the field by following the wiring diagram on the motor nameplate.

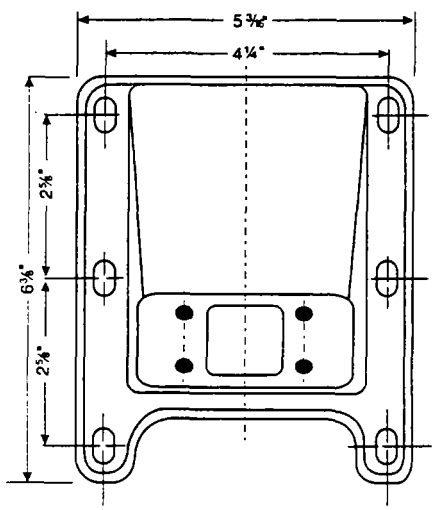
☑ **WATER PUMPING LEVEL:** Obtain the pumping water level in your well. This information is necessary to determine what installation configuration to use. The water pumping level is the level of water within the well when the pump is operating.

☑ **OPERATING CONDITIONS:** Maximum working pressure is 85 psi. Maximum fluid temperature is 95°F.

☑ **WILL THE PUMP INSTALLATION FIT?:** Check dimensional drawings of pump and base below. ***(Dimensions shown are for the JS10. Other models, overall length will be shorter.)***







SECTION 3.

Installation Procedure

Shallow or Deep Well -- A shallow well has a pumping water level of 25 feet or less. A deep well has a pumping water level of greater than 25 feet. With the use of the deep well conversion kit, the Grundfos Jet Star can be used in either shallow or deep well applications. ***Depending on the pumping water level, one of the following two installation procedures should be followed:***

Shallow Well Installation Procedure

Your shallow well installation should be very similar to that shown in Figure #1.

PUMP LOCATION: The location of the pump should be as close to the well site as possible to avoid excessive friction loss. The pump should be enclosed in a basement, shed, or pump house.

SHALLOW WELL INSTALLATION

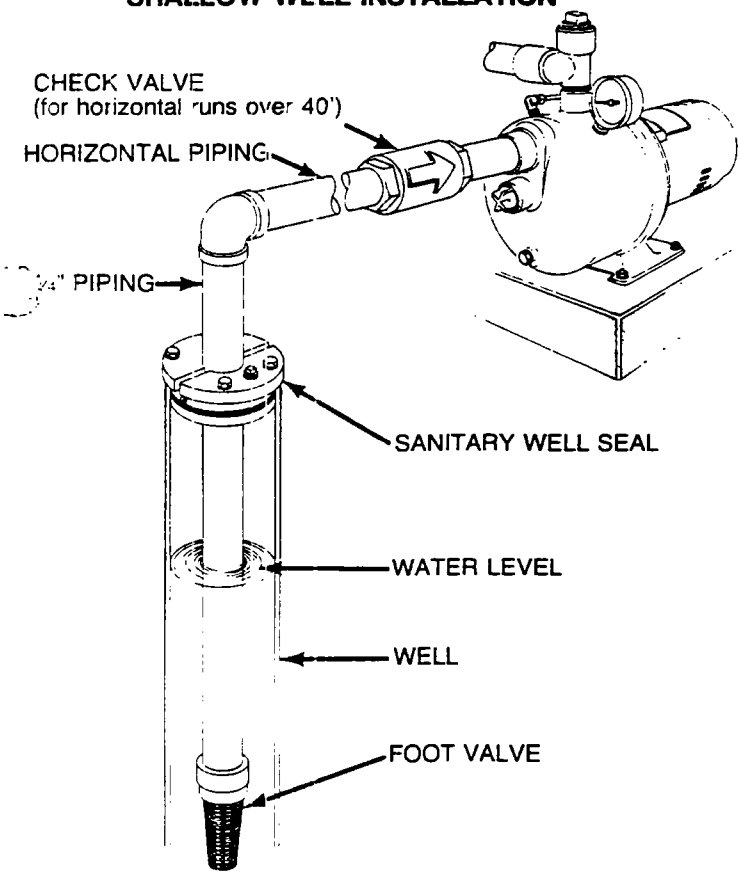


Figure #1

In addition, the pump should be located on a firm foundation and in an area that will not experience flooding or severe weather. The pump should have proper ventilation. If freezing is a possible problem, protective measures should be taken.

HORIZONTAL PIPING: Use Table #1 for the proper sizing of piping from the pump to the well site. The piping from the pump to the well site should slope toward the well at a rate of at least 1 (one) inch for every 10 (ten) feet of horizontal run. If the distance from the well to the pump is greater than 40 feet, a check valve should be installed near the pump. With this additional check valve care must be taken to prime the suction piping between the check valve and the foot valve. If rigid piping is used, it may be necessary to install a union in the piping from the well to the pump to make the connection easier.

HORIZONTAL PIPING SIZING FOR SHALLOW WELL INSTALLATION (from well to pump)

PUMP SIZE	PIPE SIZE 1¼"	PIPE SIZE 1½"
½ HP	Up to 150 Ft.	150 - 300 Ft.
¾ HP	Up to 100 Ft.	100 - 200 Ft.
1 HP	Up to 50 Ft.	50 - 100 Ft.

Table #1

VERTICAL PIPING: The vertical piping should be 1¼" in diameter and free of high points in which air could be trapped. The vertical piping should be long enough to allow the foot valve to be submerged at least 3 feet below the water pumping level. The vertical piping should be supported to prevent the pump housing from carrying the weight of the piping.

FOOT VALVE: A 1¼" foot valve should be installed on the end of the vertical piping. The foot valve should be at least two feet from the bottom of the well.

DISCHARGE PIPING: To avoid excessive friction loss, the discharge piping leading from the pump to the house should be sized according to Table #2. Failure to do so will cause the pressure to be less than expected. A plugged "T" should be installed at the discharge for priming of the pump.

DISCHARGE PIPING FOR SHALLOW WELL INSTALLATION (from pump to house)

PUMP SIZE	PIPE SIZE 1"	PIPE SIZE 1¼"
½ HP	5 - 30 Ft.	30 - 100 Ft.
¾ HP	5 - 25 Ft.	25 - 100 Ft.
1 HP	5 - 20 Ft.	20 - 70 Ft.

Table #2

PRIMING: To prime the pump and piping, remove the plug from the user installed "T" at the pump discharge. Pour water into the pump housing until the chamber is full of water and free of air.

SHALLOW WELL PRIMING

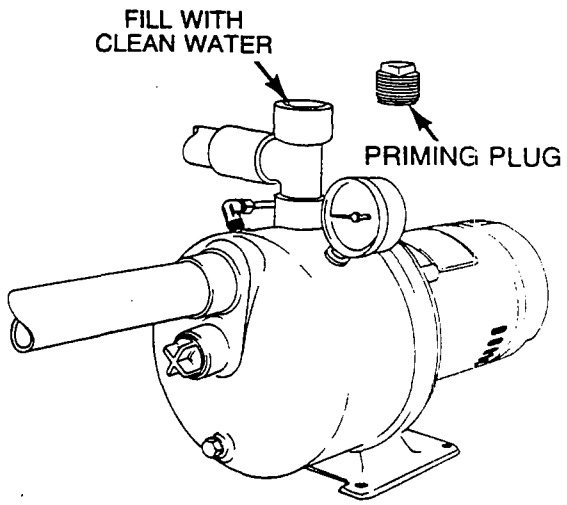


Figure #2

Deep Well Installation Procedure

Your deep well installation should be very similar to that shown in Figure #3.

DEEP WELL INSTALLATION

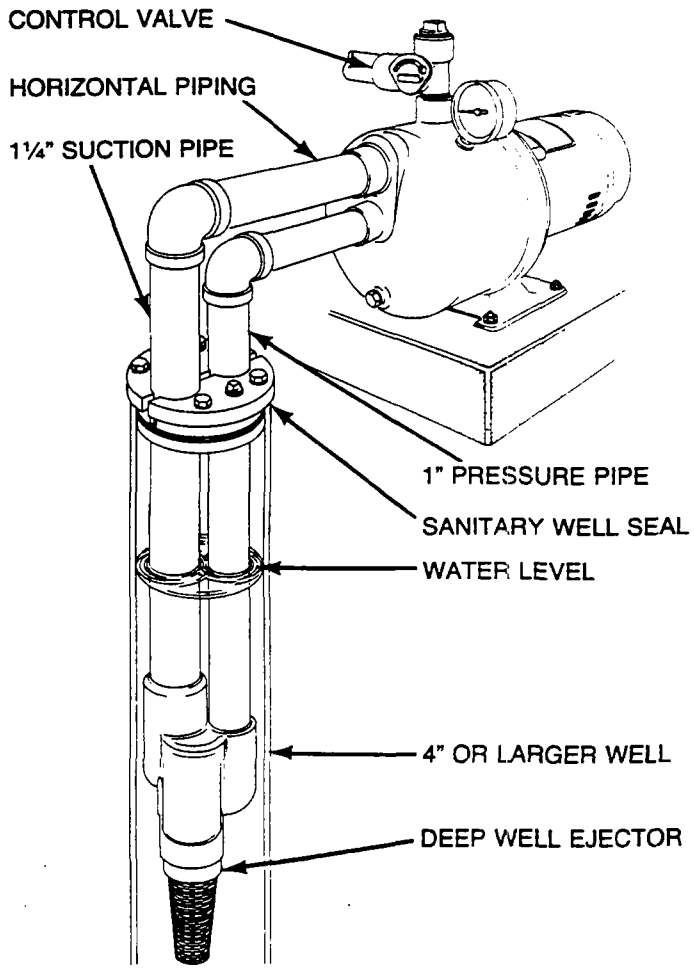


Figure #3

PUMP LOCATION: The location of the pump should be as close to the well as possible to avoid excessive friction loss. The pump should be enclosed in a basement, shed, or pump house.

In addition, the pump should be located on a firm foundation and in an area that will not experience flooding or severe weather. The pump should have proper ventilation. If freezing is a possible problem, protective measures should be taken.

CONVERSION KIT: To adapt the Grundfos Jet Star from a shallow well installation to a deep well installation, the ejector must be removed and replaced with the deep well plug as in figure #4.

CONVERSION KIT INSTALLATION

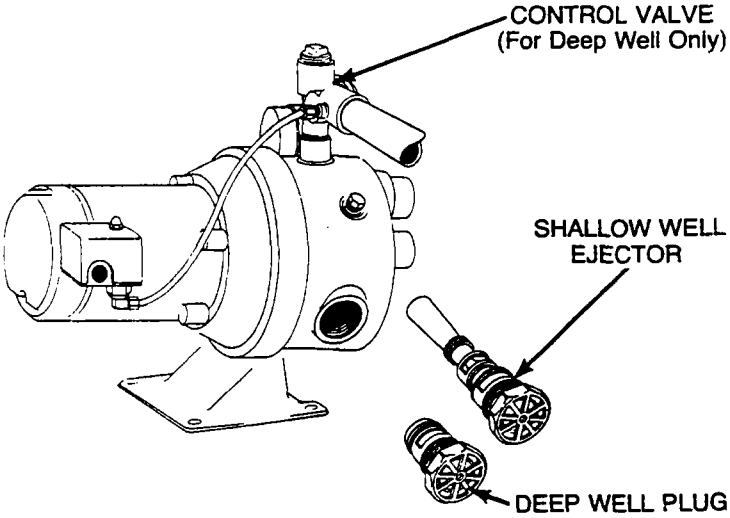


Figure #4

HORIZONTAL PIPING: Horizontal piping should be as short as possible to keep the friction loss to a minimum. Use Table #3 to obtain the proper piping size for the suction and pressure piping. The piping from the well to the pump should slope toward the well at a rate of at least 1 (one) inch per every 10 (ten) feet of piping run.

HORIZONTAL PIPING SIZING FOR DEEP WELL INSTALLATION (from well to pump)

DISTANCE: WELL TO PUMP	½ HP		¾ HP		1 HP	
	SUCT.	PRESS.	SUCT.	PRESS.	SUCT.	PRESS.
0 - 25 Ft.	1 ¼	1	1 ¼	1	1 ¼	1
25 - 50 Ft.	1 ¼	1 ¼	1 ½	1 ¼	1 ½	1 ¼
50 - 75 Ft.	1 ¼	1 ¼	1 ½	1 ½	1 ½	1 ½
75 - 100 Ft.	1 ½	1 ¼	1 ½	1 ½	2	1 ½
100 - 150 Ft.	1 ½	1 ½	2	1 ½	2 ½	2

Table #3

The pump has a 1 inch pressure port and a 1¼ inch suction port. If rigid piping is used, unions may be needed to ease in the connection to the pump. Two unions may be required and would need to be staggered from each other.

VERTICAL PIPING: The vertical piping should be long enough to allow the ejector to be submerged at least 10 feet below the water pumping level. The pressure piping should be 1 inch in diameter and the suction piping should be 1¼ inches in diameter. Screw the first lengths of piping into the ejector. Lower the ejector and piping into the well. Continue to assemble piping until proper depth is obtained. To aid in

priming, fill the piping with water prior to completing the installation. The vertical piping should be supported to prevent the pump housing from carrying the weight of vertical piping.

DISCHARGE PIPING: To avoid excessive friction loss the discharge pipe leading from the pump to the house should be sized according to Table #4. Failure to do so, will cause the pressure to be less than expected. Prime the pump through the unused port in the control valve. When priming is complete this port should be plugged.

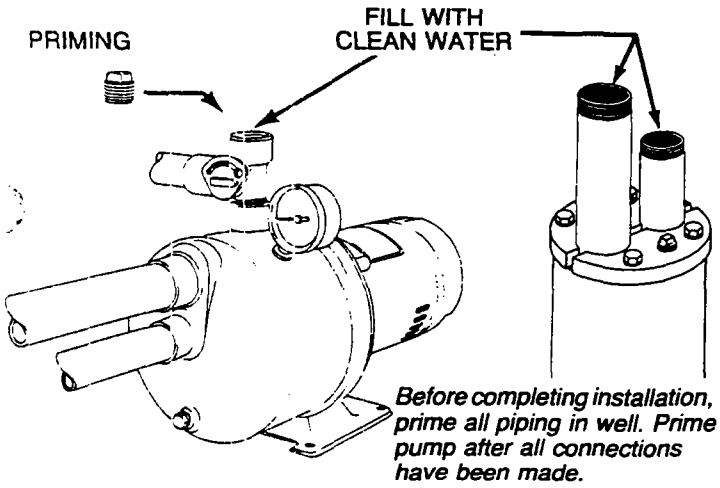
DISCHARGE PIPING FOR DEEP WELL INSTALLATION (from pump to house)

PUMP SIZE	PIPE SIZE 1"	PIPE SIZE 1¼"
½ HP	5 - 30 Ft.	30 - 100 Ft.
¾ HP	5 - 25 Ft.	25 - 100 Ft.
1 HP	5 - 20 Ft.	20 - 70 Ft.

Table #4

PRIMING: To prime the pump and piping, remove the plug from the control valve at the pump discharge. Pour water into the pump housing until the chamber is full of water and free of air.

PRIMING OF DEEP WELL INSTALLATION



Before completing installation, prime all piping in well. Prime pump after all connections have been made.

Figure #5

CONTROL VALVE: On all deep well installations a control valve is required. Based on the water pumping level, the control valve will need to be adjusted to assure the optimum performance of the pump. Adjust the control valve in the following manner:

1. Loosen the screw on the side of the valve.
2. Ensure the pump is completely primed. (See instructions.)
3. Start pump
4. Open the valve slowly until the performance of the pump is noticeably reduced and the pressure reading on the gauge is also reduced. Close valve until the performance is regained.
5. Tighten the screw.

CONTROL VALVE

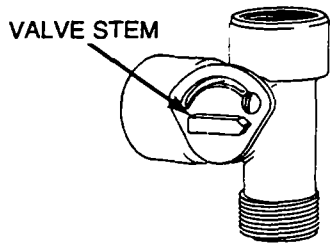


Figure #6

Tank Installation

Two types of tanks are in wide use. The standard pneumatic tank and the captive air or bladder tank. Either of these two tanks will perform well with your Grundfos Jet Star.

STANDARD PNEUMATIC TANK: A Standard Pneumatic tank has a volume of air that is compressed and in direct contact with the water. The volume of air is ejected into the tank by an air-charging system which is connected from the pump to the tank. It will be necessary to install an air volume control valve for air charging. (See Installation instructions with valve).

CAPTIVE AIR OR BLADDER TANK: A Captive air or bladder tank has a volume of air that is compressed and separated from the water by a flexible diaphragm. Because air cannot escape from the tank, an air charging system is not required. Check the air precharged pressure in the tank before filling. This pressure should be the same as the minimum pump cut-in pressure.

PRESSURE SWITCH: Your Grundfos Jet Star has a factory installed pressure switch. The switch has a cut in pressure of 30 psi and a cut out pressure of 50 psi.

SECTION 4.

Electrical Installation

Before starting your Electrical Installation, consult your local electrical code. All wiring should meet local and/or national codes. Failure to follow codes may result in damage to the motor. For your own personal protection, use extreme caution when dealing with electrical power.

Warning

Before starting the wiring installation be sure power is disconnected.

MOTOR VOLTAGES: Your Grundfos Jet Star motor is designed for use with single phase, 60 HZ, alternating current. Use with any other type of power will cause damage to the motor. Pumps with ½ horsepower motor have installed wiring for 115 volts. Pumps with ¾ or 1 horsepower motors have wiring for 230 volts. ½, ¾, and 1 horsepower motors are dual voltage and can be changed to either 115 volt or 230 volts. Consult the motor name plate for the wiring diagram to make the voltage change.

PROPER WIRE SIZE: The selection of the proper diameter wire depends on the distance of the motor to the fuse box or meter, the horsepower of the motor and voltage. Consult Table #5 for proper wire sizing. Use a three-wire conductor as specified by local and/or national code.

MINIMUM WIRE SIZE

DISTANCE: MOTOR TO FUSE BOX OR METER	MOTOR HORSEPOWER					
	½ HP		¾ HP		1 HP	
	115 V	230 V	115 V	230 V	115 V	230 V
0 - 50 Ft.	12 GA	14 GA	12 GA	14 GA	12 GA	14 GA
50 - 100 Ft.	10 GA	14 GA	8 GA	14 GA	8 GA	14 GA
100 - 150 Ft.	8 GA	14 GA	6 GA	14 GA	6 GA	14 GA
150 - 200 Ft.	8 GA	14 GA	6 GA	12 GA	6 GA	12 GA
200 - 300 Ft.	6 GA	12 GA	6 GA	10 GA	6 GA	10 GA

Table #5

Warning

All wire and fuse sizings are recommendations only. Local codes must be followed.

PROPER FUSE SIZING

MOTOR HORSEPOWER:		½ HP	¾ HP	1 HP
STANDARD	115V	30	45	50
	230V	15	25	25
DELAY	115V	10	15	17.5
	230V	5	7	8

Table #6

FUSE SIZING: The power for your pump should be on a branch or separate circuit which is protected by a fuse or circuit breaker. In addition, a disconnect switch should be visible and near the pump. See Table #6 to properly size the fuses. Never by-pass a blown fuse in an attempt to reinstate the power.

WIRE CONNECTIONS TO PRESSURE SWITCH: Connect the two incoming power wires to the line terminals in the pressure switch. See Figure #7. Connect the grounding wire to the green grounding screw on the bottom of the pressure switch. Grounding of the pump is essential for your protection and the protection of the motor. The wires from the pressure switch to the motor are factory installed.

Warning

Ensure pump is properly grounded.

WIRING OF PRESSURE SWITCH

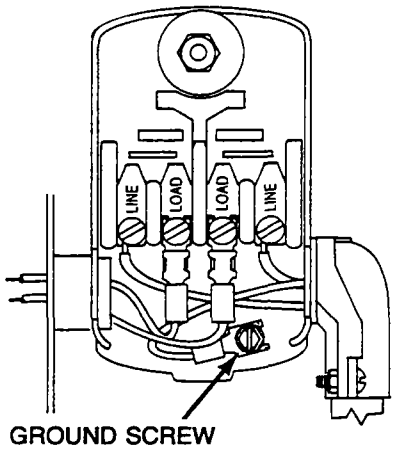


Figure #7

The pressure switch is pre-set at the factory and should not require additional adjustment. If adjustment is necessary, consult the chart that is provided in the pressure switch.

SECTION 5.

Start Up

Warning

– DO NOT RUN PUMP DRY –

Before turning on the power to the pump, the pump must be primed. If the pump is run before it is primed, damage may occur. To prime the pump and piping, remove the priming plug at the user installed "T" or control valve. Pour water into the pump housing until the chamber is full of water and free of air.

Shallow Well Start-Up

For a shallow well installation, close all the faucets down stream from the pump. Turn the pump on. Depending on the depth of the water in the well, it may take a few minutes for the pump to build pressure. It may be necessary to repeat the priming procedure if water is not obtained within a few minutes. When the pressure is obtained, open a faucet near the pump to allow any debris to exit the piping. Continue to run the pump until the water is clear.

Deep Well Start-Up

For a deep well installation, close all the faucets down stream except for one. The open faucet will allow air in the piping to escape when the pump begins to operate. Turn the control valve on the pump to the OFF position. Turn the pump on. As pressure begins to build, open the control valve until the pressure gauge fluctuates wildly and the pump starts to make noise. Close the valve a small amount until the gauge regains normal operation. Continue to run the pump until the water is clear.

SECTION 6.

Maintenance

ır Grundfos Jet Star is designed to be maintenance free. Should a problem arise, see section on ***Service*** or ***Servicing and Disassembly***.

Freezing

To avoid damage that may occur because of freezing, drain pump housing and p ping. To drain, disconnect pump from power and open a faucet to bleed off water pressure. After pressure is bled off, remove the drain plug. Precaution needs to be taken to ensure exposed tanks and piping are also drained.

Lubrication

Your Grundfos Jet Star uses water for lubrication and for this reason, cannot be operated dry. The motor is pre-lubricated at the factory.

SECTION 7.

Servicing and Disassembly

Warning

Before attempting any service or disassembly, shut off power to the pump and disconnect wires from the pressure switch.

Removal of Mechanical Seal

(For position numbers, refer to pages 8 & 9.)

1. Loosen the ¼" socket head bolt (position #10) on the clamp (position #8).
2. Remove clamp.
3. Carefully separate the motor/motor stool (position # 1, 2, and 25) from the pump housing (position #15).
4. Remove the motor cover on rear of motor.
5. Loosen and remove the screw that holds the capacitor strap in place.
6. By moving the capacitor aside, a 7/16" open wrench can be slid beneath the switch to engage the flats on the motor shaft.
7. With the motor shaft secured, rotate the impeller (position #6) counter-clockwise.
8. Removing the impeller will expose the shaft seal assembly (position #5).
9. Using two screwdrivers, pry off the rotating part of the shaft seal from the motor shaft.
10. The stationary part of the shaft seal can be removed with a small screwdriver.

Replacement of Mechanical Seal and O-rings

(For position numbers, refer to pages 8 & 9.)

11. Be sure the stationary seal recess on the cover plate (position #4) is clean.
12. Apply a thin coat of non-toxic oil or grease on the recess of the cover plate.
13. Gently push the stationary seal assembly into the recess of the cover plate. Be careful not to scratch or mar the face of the seal. Make sure the seal assembly is all the way into the recess.

Replacement of Seal (con't)

14. Clean the motor shaft.
15. Place the rotating assembly of the shaft seal on the motor shaft. Apply a light, thin coat of non-toxic oil or grease on the rubber cover of rotating seal assembly and along the motor shaft. Push the assembly along the motor shaft until the two shaft seal faces come into contact.
16. Using the procedure described in Step 6, secure the shaft and reinstall impeller by turning it in a clockwise direction.
17. Remove the shallow well ejector or deep well plug from the pump housing by turning the octagonal head counterclockwise.
18. Remove the guide vane from the pump housing.
20. Apply a thin coat of non-toxic oil or grease to the case o-ring. Install o-ring onto guide vane (position #13).
20. Re-install guide vane in pump housing. Check to see that the guide vane is positioned correctly so all of the ports line up.
21. Place o-ring (position #7) on guide vane. This o-ring seals between the pump housing and motor stool (position #2).
22. Reassemble the motor/motor stool and the pump housing. The discharge should be at the top.
23. Place clamp in position and tighten socket head bolt.
24. If using a pump with a shallow well ejector, slide o-rings (position #18 and #19) and gasket (position #20) over diffuser end of shallow well ejector.

    If using pump with a deep well plug, disregard o-ring (position #18) and slide the remaining o-ring and the gasket onto the deep well plug.
25. Re-install shallow well ejector or deep well plug.

Removal and Replacement of Motor

Warning

Ensure power is disconnected prior to removing the motor.

1. Follow Steps 1-10 in ***Removal of Mechanical Seal.***
2. Loosen and remove 4 (⅜") socket head bolts that hold motor to motor stool.
3. Remove old motor and replace with new motor.
4. Reinstall four bolts and tighten.
5. Follow steps 11-16, and 21-23 in ***Replacement of Mechanical Seal and O-rings.***

SECTION 8.

Service Guide

If the Motor Will Not Start:

1. Check to see if the motor has power. Be sure the switch is on and the fuses are not blown or circuit breaker tripped.
2. Check all wiring connections to see if they are tight. Check if motor is warm to the touch. If it is, more than likely the internal protection in the motor has been tripped. Ensure that the motor has plenty of ventilation and the proper voltage is being applied.
3. If the motor is cold to the touch and power is being applied, the motor may be defective. Contact your Grundfos dealer for a replacement motor.
4. Check the pressure switch contacts. The contacts may be stuck open or dirty. ***Extreme caution is advised. Disconnect power before cleaning.***
5. If the motor hums, disconnect power and try to rotate shaft. The shaft should rotate freely.

If the Pump Runs But Does Not Deliver Water or Pressure:

1. Be sure the pump is completely primed (see sections on priming). Repriming may be necessary.
2. Be sure the foot valve or ejector is properly submerged.
3. Check to see if the end of the foot valve or ejector is clogged or buried.
4. Check for leaks in suction piping. On deep well units, also check pressure piping.
5. On deep well installations, check ejector for a blockage or clog.
6. Check piping for blockages or clogs.
7. Check impeller for blockages or clogs.

If Pump Won't Shut Off:

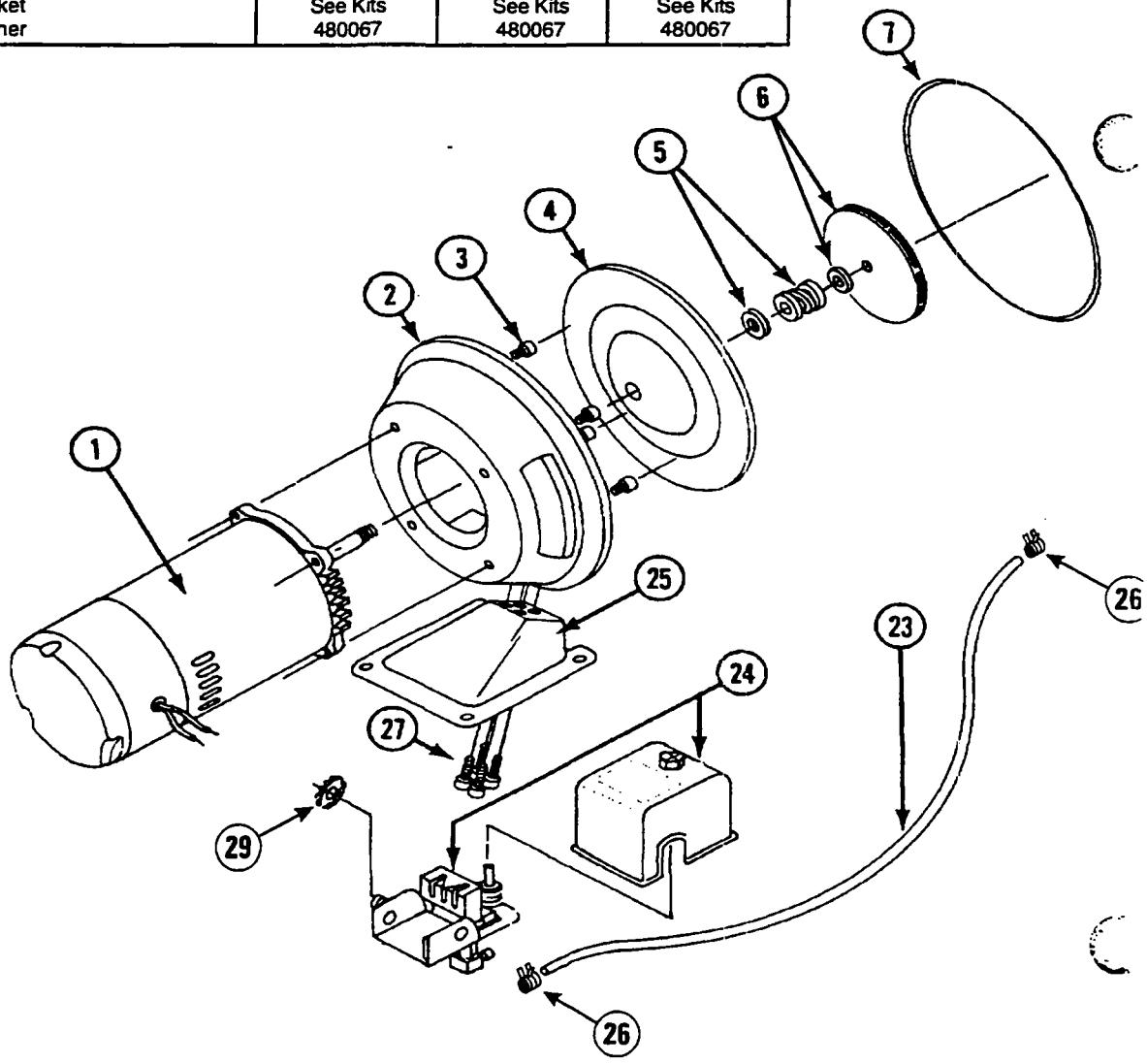
1. Check pressure switch for proper setting.
2. Check piping from pump to house for leaks.
3. Check port of pressure switch – it may be clogged or blocked. To clean, turn off power, remove power lead, remove switch from piping, clean port.
4. Check for leaks in suction line.
5. Check water pumping level.
6. If motor is not running at correct speed, check for proper motor connections and voltage.

If Pump Starts and Stops too Often:

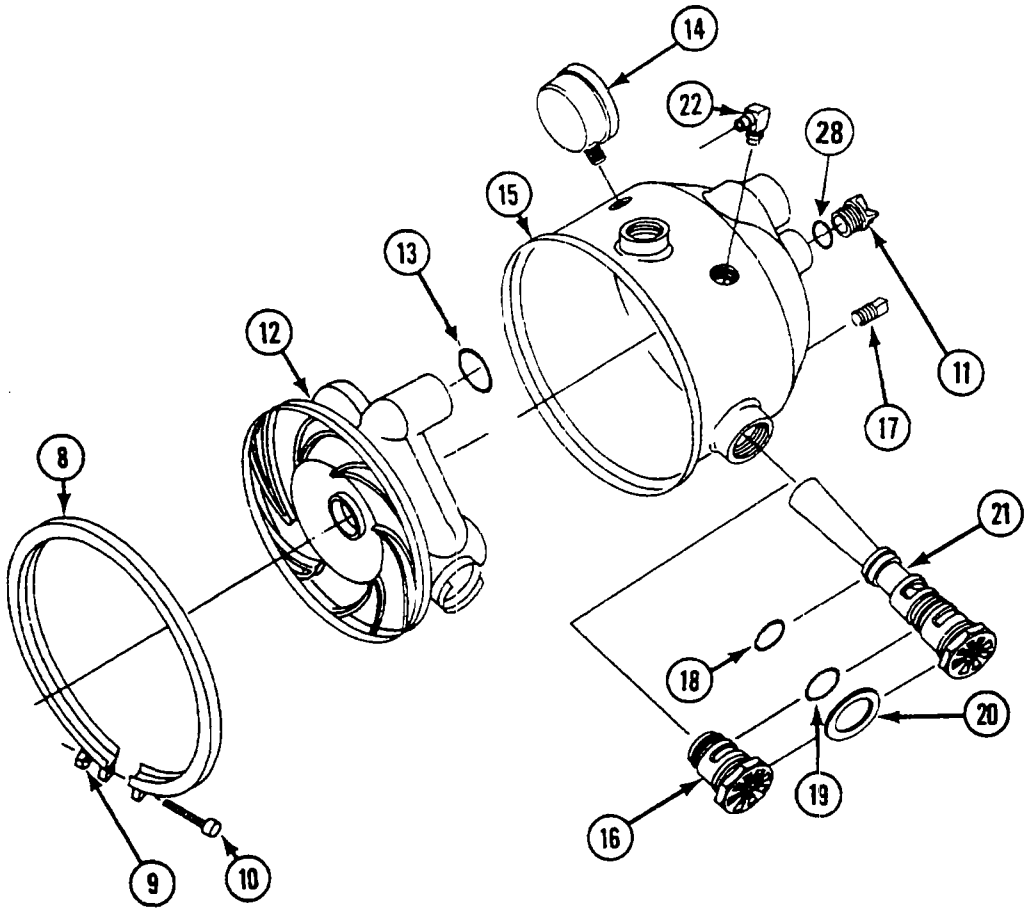
1. Check to see if storage tank is water logged. Check air control valve – it may be defective.
2. Check for leaks in piping from pump to house.
3. Be sure storage tank does not leak.

Jet Star Components
1/2, 3/4, 1 Horsepower

Pos.	Quantity Rec.	Description	Part Number		
			1/2 HP	3/4 HP	1 HP
1	1	Motor	84Z03110	84Z03111	84Z03112
2	1	Motor Stool	460154	460154	460154
3	4	Motor Bolts, 3/8" - 16 UNC 1"	See Kits	See Kits	See Kits
4	1	Cover Plate	465142	465142	465149
5	1	Shaft Seal 5/8"	See Kits	See Kits	See Kits
6	1	Impeller Kit	See Kits	See Kits	See Kits
7	1	O-Ring 194.5mm x 3mm	See Kits	See Kits	See Kits
8	1	Clamp	See Kits	See Kits	See Kits
9	1	Clamp Nut	See Kits	See Kits	See Kits
10	1	Socket Head Bolt 3/16"	See Kits	See Kits	See Kits
11	1	Finger Plug 1"	See Kits	See Kits	See Kits
12	1	Guide Vain	465140	465140	465146
13	1	O-Ring 1.359" x 0.139"	See Kits	See Kits	See Kits
14	1	Pressure Guage	ID3623	ID3623	ID3623
15	1	Pump Housing	465143	465143	465143
16	1	Deep Well Plug	See Kits	See Kits	See Kits
17	1	Pipe Plug 1/4" NPT	See Kits	See Kits	See Kits
18	1	O-Ring1.045" x .139"	See Kits	See Kits	See Kits
19	1	O-Ring 1.171" x .139"	See Kits	See Kits	See Kits
20	1	Gasket	See Kits	See Kits	See Kits
21	1	Shallow Well Ejector	See Kits	See Kits	See Kits
22	1	Pressure Switch Fittings	See Kits	See Kits	See Kits
23	1	Pressure Switch Tubing	See Kits	See Kits	See Kits
24	1	Pressure Switch	ID00436	ID00436	ID00436
25	1	Base	460155	460155	460155
26	2	Hose Clamps	See Kits	See Kits	See Kits
27	4	Base Bolts	See Kits	See Kits	See Kits
28	1	Gasket	See Kits	See Kits	See Kits
29	1	washer	480067	480067	480067



Jet Star Components



Jet Star Kits
1/2, 3/4, 1 Horsepower

Description	Part Number		
	1/2 HP	3/4 HP	1 HP
Shaft Seal: includes position #5	465126	465126	465126
O-Ring & Gasket Kit.: includes positions # 7, 13, 18, 19, 20,	465127	465127	465127
Shallow Well Ejector Kit: includes positions # 18, 19, 20, 21	465108	465109	465166
Plug Kit: includes positions # 11, 17, 28	465114	465114	465114
Tubing Kit: includes positions # 22, 23, 26	465115	465115	465115
Bolt Kit: includes positions # 3,9, 10, 27	465116	465116	465116
Deep Well Plug Kit: includes positions # 16, 19, 20	465117	465117	465117
Impeller Kit: includes position # 6	465168	465169	465170
Clamp Kit: includes positions # 8, 9, 10	465167	465167	465167

Limited Warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. *Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of* said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES *DESCRIBED OR REFERRED TO ABOVE.*

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

GRUNDFOS®

GRUNDFOS Pumps Corporation • 2555 Clovis Avenue, Clovis, CA, 93612
Regional Centers: Allentown, PA • Atlanta, GA • Chicago, IL • Clovis, CA • Dallas, TX • Seattle, WA
Phone: (800) 333-1366 • **FAX:** (800) 333-1363
In Canada: Mississauga, ONT • **Mexico:** Apodaca, N.L.

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10.7) CARBON VESSELS

GREAT LAKES CARBON TREATMENT, INC.
MODEL # LP4

Great Lakes Carbon Treatment Inc.

3300 US-131 North
P.O. Box 968
Kalkaska, MI 49646
1-800-258-8014
PHONE (616) 258-8014
FAX (616) 258-6993

1617 Pratt Avenue
Marshall, MI 49068
1-800-841-8324
PHONE (616) 781-1063
FAX (616) 781-8241

SPECIFICATIONS FOR THE
GLC 400# LIQUID PHASE
GRANULAR ACTIVATED CARBON UNIT.

1. USE: THIS UNIT IS USED TO REMOVE LIQUID PHASE CONTAMINANTS SUCH AS BENZENE, ETHYL BENZENE, TOLUENE, XYLENE AND NAPHTHALENE FROM A STREAM OF INFLUENT WATER, USUALLY GROUND WATER. TWO OR MORE VESSELS ARE USED IN SERIES, WITH A LEAD VESSEL, SAMPLE PORT AND A VESSEL TO POLISH THE EFFLUENT WATER. WHEN TESTS FROM THE SAMPLE PORT SHOW THE LEAD VESSEL IS USED UP, THE FLOW IS SHUT OFF AND THAT VESSEL IS REFILLED WITH FRESH CARBON. THEN THE FLOW IS ROUTED TO THE SECOND VESSEL FIRST, AND THEN BACK THROUGH THE NEW CARBON. THE NEW CARBON VESSEL IS NOW THE POLISH VESSEL AND THE OLD POLISH VESSEL IS NOW THE NEW LEAD VESSEL.

2. CARBON CAPACITY: 400# OF GRANULAR ACTIVATED LIQUID PHASE CARBON PER VESSEL. A 20% VOLUME ALLOWANCE FOR FLUIDIZING THE CARBON DURING BACKFLUSHING IS PROVIDED.

3. NOMINAL FLOW RATE: 12 GPM

4. EMPTY BED CONTACT TIME: 1 FRP VESSEL: 10.0 MINUTES

   CALCULATIONS: 1 FRP VESSEL: 120 GAL/12 GPM = 10.0 MINUTES

   EPA GUIDLINE FOR MINIMUM CONTACT TIME IS: 7.5 MINUTES

5. HYDRAULIC LOADING: 3.822 GAL/ SQ FT

   CALCULATIONS: BED DIAMETER: 24 INCHES OR 2 FEET
   BED AREA: 452 SQ IN OR 3.14 SQ FT.

   HYDRAULIC LOADING=FLOW RATE/BED AREA=12 GPM/3.14 SQ FT
   =3.822 GAL/ SQ FT

6. VOLUME: ONE VESSEL: 120 GAL OR 16 CUBIC FEET

7. DESCRIPTION OF VESSEL:

FLOW DIRECTION: DOWN FLOW
TOP INFLUENT CONNECTION, MALE CAMLOCK
TOP PRESSURE GAGE
TOP AIR ELIMINATOR
TOP DISTRIBUTOR: STACKED, .015 SLOTS
400 POUNDS LIQUID PHASE CARBON
BOTTOM DISTRIBUTOR: 8 SLOTTED FINGERS, .015 SLOTS
MATERIAL: FRP (FIBERGLASS REINFORCED POLYESTER)
DIAMETER: 24 INCHES
LEGS: MOLDED RING BASE
WEIGHT: 126 LBS
FLOOR TO BOTTOM COUPLING: 8.4 INCHES
HEIGHT: 79 INCHES
VOLUME: 120 GAL OR 16 CUBIC FEET.

8. OPERATING TEMPERATURE: 50 TO 120 DEGREES F.

9. OPERATING PRESSURE: 150 PSI

10. CARBON: GRANULAR ACTIVATED CARBON, LIQUID PHASE.

MESH SIZE: 8 X 30
IODINE NUMBER: 900 MINIMUM
CARBON TETRACHLORIDE ACTIVITY: 62% MINIMUM
APPARENT DENSITY, LBS/CU FT: 30 AVERAGE
TOTAL ASH CONTENT: 8% MAXIMUM
HARDNESS (BALL ABRASION): 90 AVERAGE
REACTIVATED: YES, VIRGIN AVAILABLE ON REQUEST.

11. CARBON CHANGE OUT:

NOTE ALLOW 18" ABOVE THE VESSEL FOR INSTALLATION AND REMOVAL OF CARBON WITH A VACUUM HOSE.

METHOD: VACUUM IN, VACUUM OUT.
AVERAGE TIME PER VESSEL: 30 MINUTES
CAN DISTRIBUTOR BE CHECKED FOR CLOGGED OR BROKEN?:
YES, EACH CHANGE OUT.

CAUTION: 24 HOUR WET OUT OF CARBON WITH POTABLE OR SYSTEM WATER REQUIRED.

12. EXPECTED LIFE OF CARBON IN UNIT: SEND REQUEST TO GLC ENGINEERING WITH EXPECTED CONTAMINANTS, ACTUAL FLOW RATE, HUMIDITY AND TEMPERATURE. HARDWARE HAS A ONE YEAR WARRANTY AGAINST DEFECTS IN MATERIAL OR WORK-MANSHIP.

13. EXPECTED OPERATING EXPENSES: SEND REQUEST WITH PARTICULARS.

14. SEE FIGURE 1 FOR ILLUSTRATION.

15. LAST REVISION: 26 MAY 93

FILE IS: SPEC200L.WPS/PROPOSALS

NOTES:

1) OPERATING PRESSURE – 150 PSI
2) OPERATING TEMP – 120 DEGREES F.
3) VESSEL CAPACITY – 120 GALLONS OR 16 CUBIC FEET
4) FLOW RATE – UP TO 12 GPM

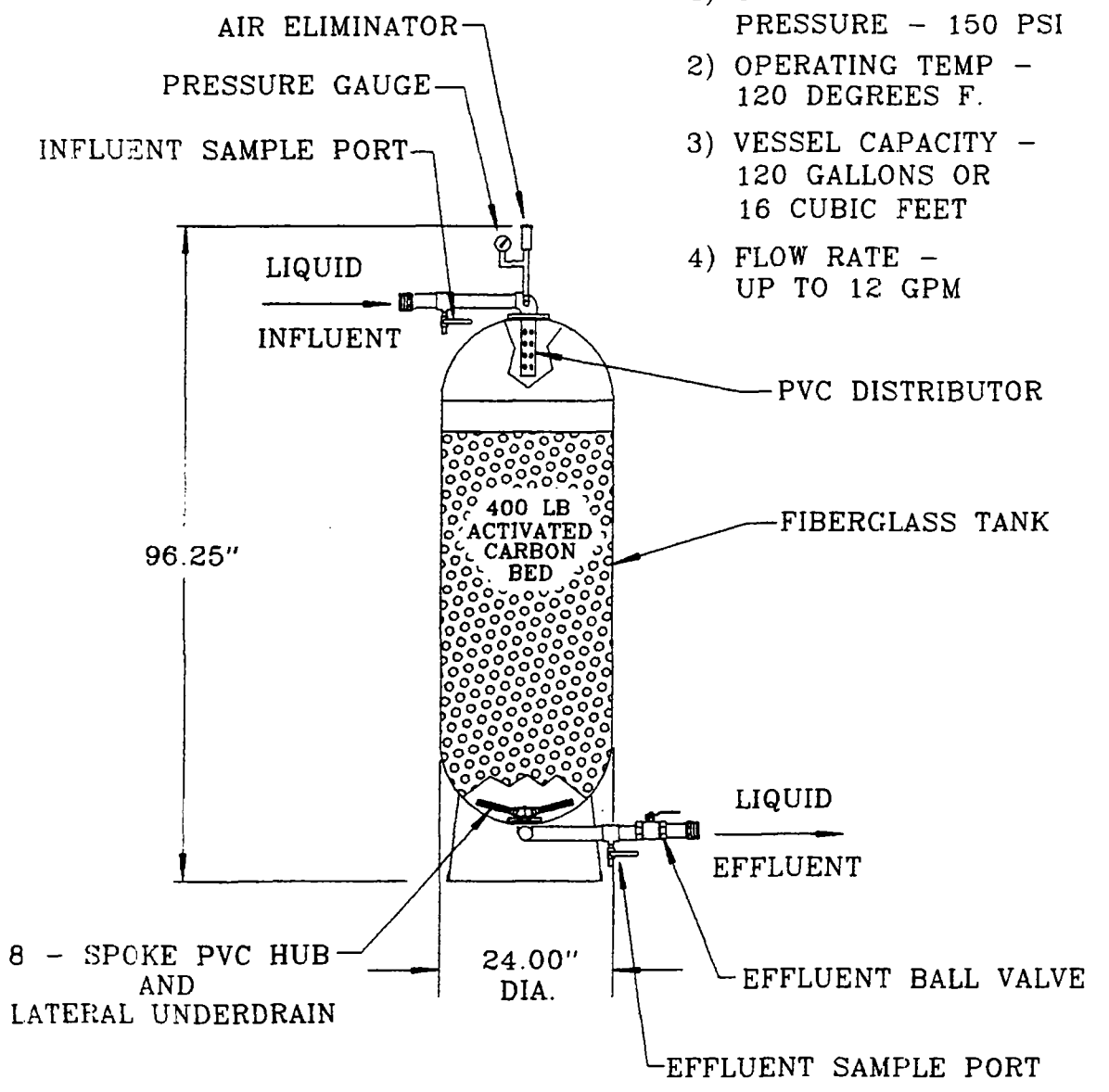


FIGURE #1

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

400 LB
LIQUID PHASE
CARBON VESSEL

SCALE: NONE	TOLERANCES: XXX / XX / X	DRAWN BY: S. KRELLWITZ
DATE: 1 APRIL 1994		
SHEET	ENGINEER:	DR. NUMBER: 400LIT

10.8) CARBON

GREAT LAKES CARBON TREATMENT, INC.
MODEL # GLCT-CBR-830L

CARBON SPECIFICATIONS

GLCT-CBR-830L

GLCT's Coal-Based, Reactivated 8 X 30 sieve carbon for liquid filtration.

Used for environmental applications where groundwater is processed and water quality (especially iron content and biological activity) is suspect. It offers the premium performance of virgin carbon at about seventy-five percent (75%) of the cost. Typical applications include the clean-up of Volatile Organic Compounds (VOCs) dissolved in water (such as BTEX, PCE, TCE, and DCE).

Physical Properties

Iodine Number (mg/g), Minimum	900
Molasses Number, Minimum	200
Abrasion Number, Minimum	70
Moisture (as packed), Maximum	2%
U.S. Standard Sieve Size	
Greater than No. 8 (Maximum)	5%
Less than No. 30 (Maximum)	5%
Apparent Density, Minimum	0.47%

GLCT-CBR-410V

GLCT's Coal-Based, Reactivated 4 X 10 sieve carbon for vapor filtration.

Used for adsorption of VOCs (such as BTEX and Chlorinated Solvents) in Soil Vapor Extraction applications. It works best when influent vapor is below fifty percent (50%) relative humidity, and between 75 and 125 degrees Fahrenheit. Its large sieve size means very low restrictive pressure in most applications.

Physical Properties

Carbon Tetrachloride Activity (wt.%), Minimum	60
Iodine Number (mg/g), Minimum	1000
Hardness Number, Minimum	90
Ash (wt.%), Maximum	12
Moisture (wt.%), Maximum	2
U.S. Standard Sieve Size	
Greater than No. 4 (Maximum)	5%
Less than No. 10 (Maximum)	5%
Apparent Density	0.425

10.9) PRESSURE SWITCH

SQUARE "D"
PUMPTROL PRESSURE SWITCH
SERIES B, CLASS 9013, TYPE FSG2

Commercial Pressure Switches

Types FSG, FYG, FRG – PUMPTROL® Water Pump Pressure Switch Order Information

Class 9013

- Designed for the control of electrically driven water pumps.
- Type FSG is the standard water pump switch, suitable for all types of pumps: jets, submersible, reciprocating, etc.
- Type FYG is designed to meet higher horsepower and pressure requirements.
- Type FRG is reverse acting: contacts open on falling pressure.
- Diaphragm actuated.
- See page reference below for the following:

Pressure Code Table

Code	Pressure Setting Close-Open
J20	20-40 PSI
J21	30-50 PSI
J23	40-20 PSI
J24	40-60 PSI
J25	60-80 PSI
J99	Specify Setting Required

Ordering Information

1. Specify Class 9013 Type FSG, FYG, FRG.
2. Select pressure code from Pressure Code Table at left and add code designation to end of type number. Be sure that pressure code falls within the limits of the device as shown in the device listings below.
3. If special features are desired, add the appropriate Form letter to the Class and Type. Arrange Form letters in alphabetical sequence when ordering more than one special feature.
4. Place packaging code in alphabetical sequence.
   For standard pack of 20 devices per box..... C20•
   For individual packaged devices..... leave blank ■

NOTE: If no packaging code is indicated, devices will be shipped individually packaged.

Selection Tables

Reverse Action: Contacts Open On Falling Pressure

Approximate Adjustable Differential (PSIG)	Cut-Out Range (PSIG)	Pressure Connection	1 Pole Type	1 Pole Price	2 Pole Type	2 Pole Price
15-30	8-45	¼" NPSF Internal ⅜" NPSF Internal	FRG-12 FRG-13	$28.40 29.40	FRG-2 FRG-3	$31.00 31.00
		½" Flare ¼" NPT External	FRG-18 FRG-19	29.40 29.40	FRG-8 FRG-9	31.00 31.00
6-20	4-25	½" NPSF Internal ⅜" NPSF Internal	FRG-32 FRG-33	32.40 32.40	FRG-22 FRG-23	34.00 34.00
		½" Flare ¼" NPT External	FRG-38 FRG-39	32.40 32.40	FRG-28 FRG-29	34.00 34.00
5 Non-Adjustable	1-11	¼" NPSF Internal ⅜" NPSF Internal	FRG-52 FRG-53	32.40 32.40	FRG-42 FRG-43	34.00 34.00
		½" Flare ¼" NPT External	FRG-58 FRG-59	32.40 32.40	FRG-48 FRG-49	34.00 34.00
20-30	20-75	¼" NPSF Internal ⅜" NPSF Internal	FRG-72 FRG-73	29.40 29.40	FRG-62 FRG-63	31.00 31.00
		½" Flare	FRG-78	29.40	FRG-68	31.00
30-45	35-120	½" NPSF Internal ⅜" NPSF Internal	FRG-92 FRG-93	29.40 29.40	FRG-82 FRG-83	31.00 31.00
		½" Flare ¼" NPT External	FRG-98 FRG-99	29.40 29.40	FRG-88 FRG-89	31.00 31.00

Standard Action: Contacts Open On Rising Pressure

Approximate Adjustable Differential (PSIG)	Cut-In Range (PSIG)	† Pressure Connection	2 Pole NEMA Type 1	2 Pole Price	2 Pole NEMA Type 3R‡	2 Pole Price
15-30	5-45	¼" NPSF Internal ¼" NPSF Internal	FSG-1 FSG-2	$18.60 17.00	FSW-1 FSW-2	$21.60 20.00
		¼" NPT External ½" Bayonet (barbed) 90° Elbow ¼" Bayonet	FSG-8 FSG-10 FSG-20	17.00 17.00 18.60	FSW-8 FSW-10 FSW-20	20.00 20.00 21.60
10-30 10-30 6-20 6-20	10-30 10-45 3-10 3-10	¼" NPSF Internal ¼" NPT External ¼" NPSF Internal ¼" NPT External	FSG-22 FSG-29 FSG-42 FSG-49	21.60 21.60 21.60 21.60	FSW-22 FSW-29 FSW-42 FSW-49	24.60 24.60 24.60 24.60
15-30	19-45	(FSG1-20 WITH FORM M4)				
20-30	5-60	⅛" NPSF Internal ¼" NPSF Internal	FYG-1 FYG-2	26.30 24.80	FYW-1 FYW-2	29.30 27.80
		¼" NPT External ¼" Bayonet (barbed) 90° Elbow ¼" Bayonet	FYG-9 FYG-10 FYG-20	24.80 24.80 26.30	FYW-9 FYW-10 FYW-20	27.80 27.80 29.30
20-30	19-60	(FYG1-20 WITH FORM M4)				
10-30 10-30 6-20 6-20	10-30 10-45 3-10 3-10	¼" NPSF Internal ¼" NPT External ¼" NPSF Internal ¼" NPT External	FYG-22 FYG-29 FYG-42 FYG-49	29.40 29.40 29.40 29.40	FYW-22 FYW-29 FYW-42 FYW-49	32.40 32.40 32.40 32.40

Must be mounted in vertical position to maintain enclosure rating.

Special Features And Modifications For Type FSG, FYG & FRG Devices

Description	Applies to	Form Letter	Price Addition
Standard Pack of 20 Devices per box	All Type F	C20	N/C
Pilot Light - Indicates Switch Contacts Closed	FSG, FYG	G5*	$ 7.80
One Normally Open-One Normally Closed Contact	FRG 2 Pole Only	H	6.20
Maintained Manual Cut-Out Lever (AUTO-OFF)	FSG, FYG	M1	3.20
Momentary Manual Cut-In Lever (AUTO-START)	FRG2-59 Only	M3	3.20
Low Pressure Cut-Off (AUTO-START-OFF) Operates at Approximately 10 PSIG Below Cut-In and will turn off the pump	FSG, FYG	M4	6.40
Maintained Manual Cut-In Lever (AUTO-ON)	FRG2-59 Only	M5	3.20
Pulsation Plug (Standard on FSG-4 and FYG-4)	FRG, FSG, FYG	P*	.45
Salt Water Flange (¼ NPSF Internal Only)	All Type F	Q*	15.50
Plastic Flange (max. temp. 120°F) (max. pressure 50 psi)	FSG, FYG	Q8	7.50
	¼" NPSF Internal Only		
½" Conduit Bushing - ½" Long Thread - on Left	All Type F	T	2.50
½" Conduit Bushing - ½" Long Thread - on Right	All Type F	T1	2.50
Slip-On Connectors (Load Side Terminals Only)	FSG, FYG	U	.30
Slip-On Connectors (Line and Load Terminals)	FSG, FYG	U2	.60
Black Cover	FSG, FYG	Z22	N/C

* Can be field installed. Nameplate should then be marked with the Form letter and maintenance and ordering records corrected.
• Nylon pulsation plug can be field installed on types having ¼" NPSF internal connector. Part number 1530-S6-G1 is one bag of 50 plugs.

UL File E12158 Guide NKPZ CSA File LR25490

PUMPTROL is a Registered Trademark of Square D Company.

10.10) FLOOR SUMP LEVEL SWITCH

MURPHY
MODEL : L-1200 SF

Installation for L1100, L1200, and L1200N Series Liquid Level Switches and DV750, DV1500, and DV2000 Dump Valves

LDV-92151N
Revised 09-93

Patents 3970099, 4505288, and 4573489

Please read the following instructions before installing. A visual inspection for damage during shipping is recommended before mounting. General Information and these installation instructions are intended for all L1100, L1200, and L1200N Series Level Switches. In addition: DV750, DV1500, and DV2000 Dump Valves.

GENERAL INFORMATION

WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.
- ✓ OBSERVE all pressure and electrical ratings and requirements for the devices and the operating environment.
- ✓ BE SURE all pressure HAS BEEN REMOVED from the vessel before opening any pressure connections.

Description

Series L1100 and L1200 Liquid Level Switches are float activated to operate an electrical SPDT snap switch (optional DPDT on some models) for alarm or shutdown of an engine or electric motor. They screw directly into the wall of the vessel. Series L1200 can also be used with a weld collar or external float chamber.

Series L1200N is a float-activated, pneumatic-vent level device used to operate dump valves or similar devices. This model screws directly into the vessel or can be mounted via an external float chamber. It **cannot** be used with weld collar 15-05-0375. Model variations include a dump valve operator with or without a filter/pressure regulator and indicating pressure gauge.

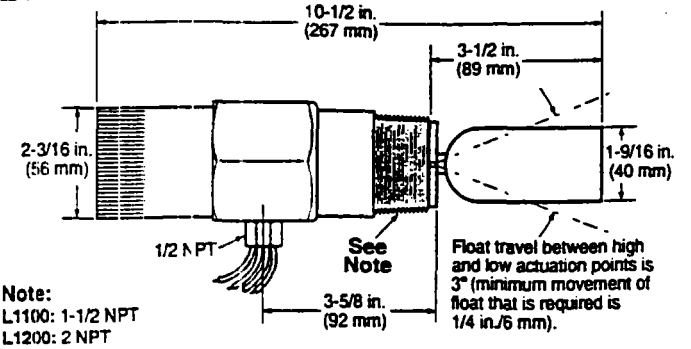
Series DV750, DV1500 and DV2000 Dump Valves receive a pneumatic input signal to cause an orifice to open or close allowing liquid condensate to be drained from a pressure vessel. The drain orifice is located inside the pressure vessel and, therefore, is considered to be freeze-proof.

Specifications	L1100	L1111	L1150	L1200	L1250	L1200N	L1200N-DVO	L1200N-DVOR
Body								
• Standard: Electroless Nickel plated steel	✗[A]	✗[A]	✗[A]	✗[B]	✗[B]	✗[B]	✗[B]	✗[B]
• Optional: AISI 316 Stainless Steel	✗[A]	✗[A]	✗[A]	✗[B]	✗[B]	✗[B]	✗[B]	✗[B]
Pressure Rating								
• 15 psi (103 kPa)			✗		✗			
• 1500 psi (10.3 MPa)	✗	✗		✗		✗	✗	✗
Temperature Rating								
• Standard: 300°F (149°C)	✗	✗	✗	✗	✗	✗	✗	✗
• Optional: 400°F (204°C)	✗	✗		✗		✗	✗	✗
Specific Gravity								
• Standard: 0.5 with BUOYGLAS™ float	✗	✗		✗		✗	✗	✗
• Optional: 0.65 with 304 Stainless Steel	✗	✗		✗		✗	✗	✗
• Standard 0.73 Polyethylene Float			✗		✗			
Electrical								
• Standard SPDT: 5A @ 125/480 VAC (see page 3 for full ratings)	✗	✗	✗	✗	✗			
• Optional DPDT: 10A @ 250 VAC (see page 3 for full ratings)	✗	✗	✗	✗	✗			
Wire: 18AWG x 36 in. (914 mm)	✗	✗	✗	✗	✗			
O-Rings: Viton	✗	✗	✗	✗	✗	✗	✗	✗
Valve: Two-way snap-action vent type • 1/8 in. (3 mm) orifice w/Viton "A" seat • 1/8 NPT inlet; 1/4 NPT outlet • 30-70 psi (207-483) kPa operating pressure						✗	✗	✗
Dump Valve Operator: Operates Murphy DV Series dump valves or similar.							✗	✗
Pressure Regulator/Filter and Murphy 20BPG: 0-75 psi (0-517 kPa) pressure gauge. Maximum input 300 psi (2.07 MPa).								✗
Operation: H=For high level, L=For low level	H	L	H	H	H	H	H	H

[A]=1-1/2 in. 11-1/2 NPT [B]=2 in. 11-1/2 NPT

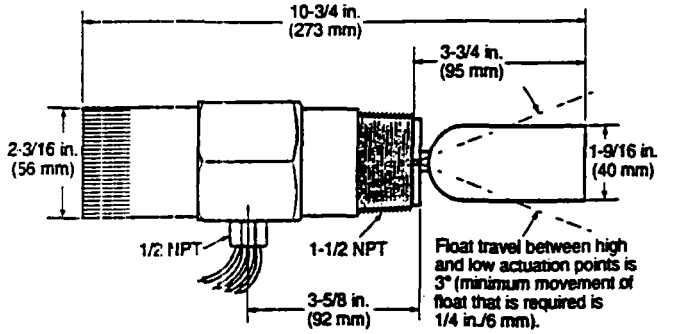
DIMENSIONS

L1100 and L1200

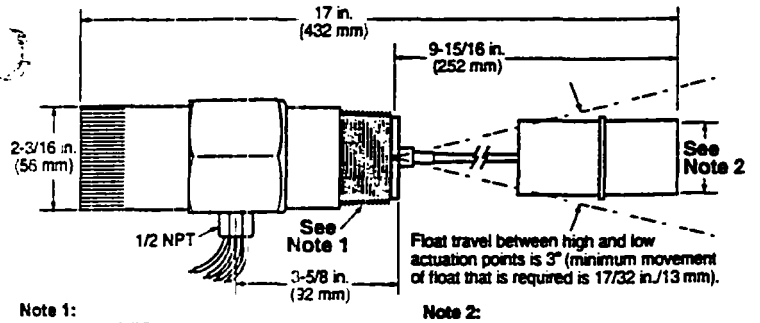


Note:
L1100: 1-1/2 NPT
L1200: 2 NPT

L1111



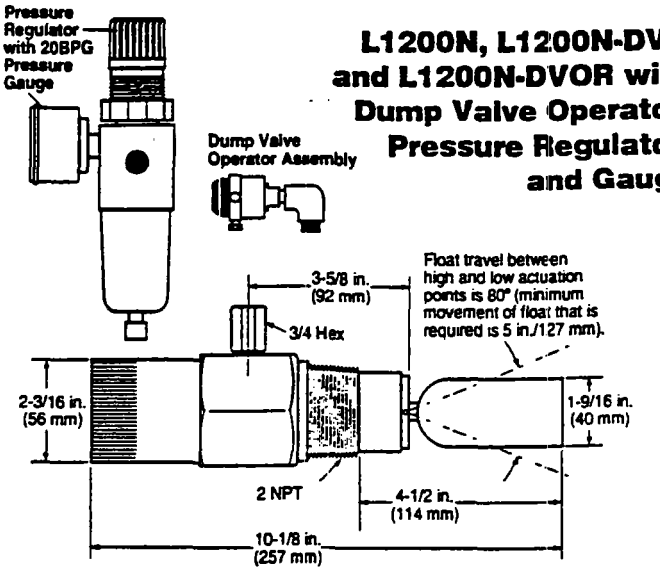
L1150 and L1250



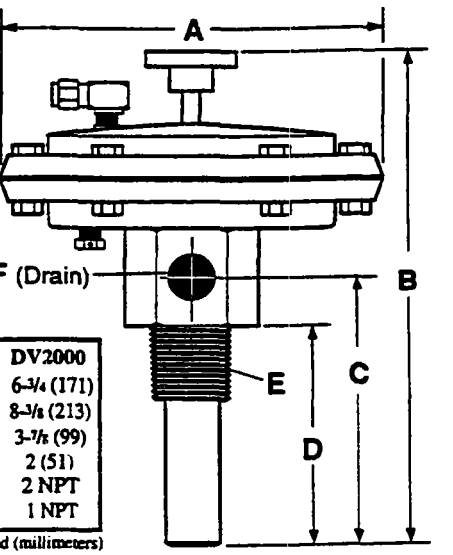
Note 1:
L1150: 1-1/2 NPT
L1250: 2 NPT

Note 2:
L1150: 1-1/2 in. (38 mm)
L1250: 2 in. (51 mm)

L1200N, L1200N-DVO and L1200N-DVOR with Dump Valve Operator, Pressure Regulator, and Gauge



DV750, DV1500, and DV2000 Dump Valves



	DV750	DV1500	DV2000
A	6-3/4 (171)	6-3/4 (171)	6-3/4 (171)
B	6-7/8 (175)	8-7/8 (226)	8-3/8 (213)
C	2-7/8 (73)	4-7/8 (124)	3-7/8 (99)
D	2 (51)	4 (102)	2 (51)
E	1 NPT	1 NPT	2 NPT
F	1/2 NPT	1/2 NPT	1 NPT

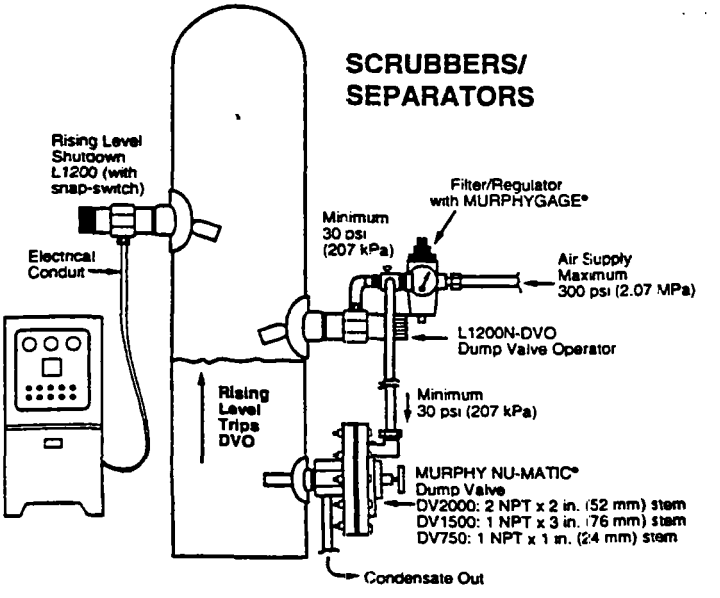
NOTE: Dimensions are in inches and (millimeters)

TYPICAL INSTALLATION ON GAS COMPRESSORS

Basic Operation

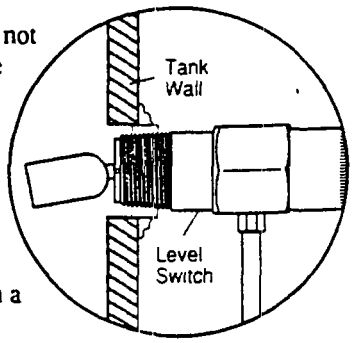
When the liquid in the scrubber tank rises to the level of the L1200N, its float rises and opens the pneumatic orifice. This allows the pneumatic signal to vent to the DV Series dump valve causing it to open and drain the liquid in the scrubber. As the liquid level falls in the scrubber, the L1200N float causes the pneumatic orifice in the L1200N to close. This removes the pneumatic signal from the dump valve causing it to close.

If liquid level continues to increase in the scrubber faster than the dump valve can remove it, the float of the L1200 switch will rise. This operates the electrical snap switch(es) which in turn operate(s) the shutdown system of the compressor driver. A fault signal can be annunciated in the control panel indicating the cause of shutdown.



PRESSURE VESSEL INSTALLATION: L1100, L1200, and L1200N

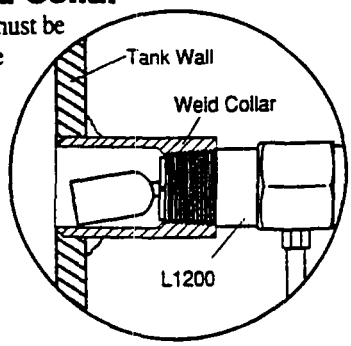
Direct Installation into the Wall of the Pressure Vessel



Determine that the float travel is not obstructed by the coupling in the vessel wall, internal baffles, etc. Do NOT use more than one arm extension P/N 15-05-0395.

2. BE SURE that the float and extension are tight and that the lock washer is in place.
3. Before installing the level switch a suitable pipe thread sealant is recommended. Screw the unit directly into the threaded connection in the wall of the pressure vessel.
4. Be sure that the electrical connection is positioned at the bottom. For L1200N the 1/8 NPT pneumatic connection should be on top (the 1/4 NPT vent connection should be on the bottom). See "Pneumatic models" section for further instructions for the L1200N.
5. Make the electrical wiring connections according to appropriate wiring diagrams for the alarm or shutdown system to be used. The electrical connection is 1/2-14 NPT.
6. BE SURE all electrical connections are insulated and that the cover is fully installed before reconnecting electrical power.
7. BE SURE all pressure connections are tight before pressurizing the system.

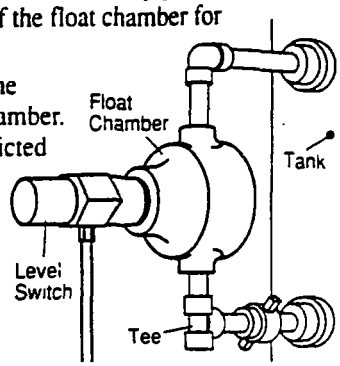
Installation with a Weld Collar



1. The weld collar, P/N 15-05-0375, must be welded into the wall of the pressure vessel according to code standards and good welding practices.
2. Follow above instructions for installation directly into the wall of the pressure vessel.
3. **NOTE: Weld collar 15-05-0375 can be used ONLY with model L1200.**

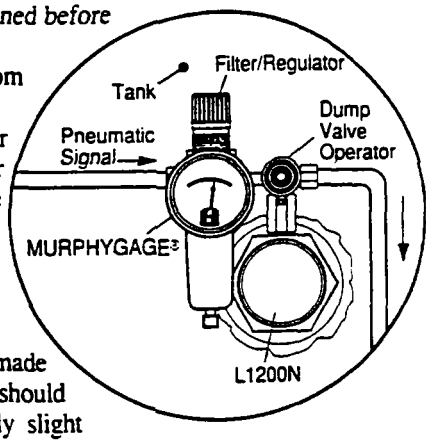
Installation Using External Float Chamber 15-05-0697

1. Install float chamber 15-05-0697 on the outside wall of the pressure vessel using 1 NPT piping. Position the 2 NPT threaded connection at the height where you want the level switch to operate. The 2 NPT threaded connection must be positioned away from the tank wall.
2. A tee installed at the bottom of the lower 1 inch pipe riser is recommended to allow draining of the float chamber for servicing.
3. Install the L1200 or L1200N in the 2 NPT connection of the float chamber. BE SURE float travel is not restricted and that the float is tight onto the float shaft.
4. To complete installation and wiring, follow the instructions for mounting directly into wall of the vessel and for wiring.

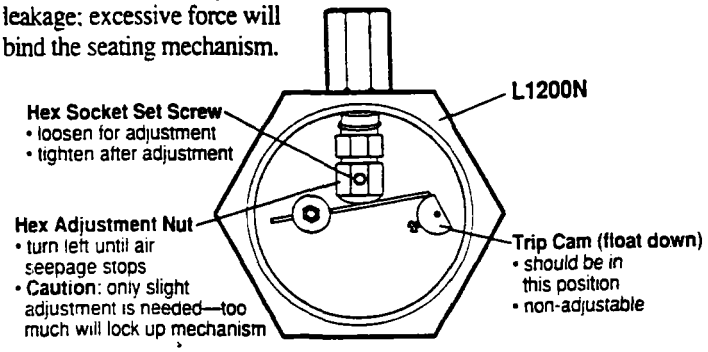


Pneumatic Models

1. All pneumatic models operate on the vent principle. The pneumatic signal source MUST BE CLEAN AND DRY. The input pneumatic signal must be regulated between 30 and 70 psi (207-483 kPa). If produced gas is used as the signal source, it should be taken after gas passes through the final scrubber. A *suitable filter must be positioned before* the L1200N-DVO to prevent liquids and/or particulates from entering the dump valve operator. **NOTE:** Check filter periodically for wear and tear and elements that hamper the flow of the pneumatic signal.



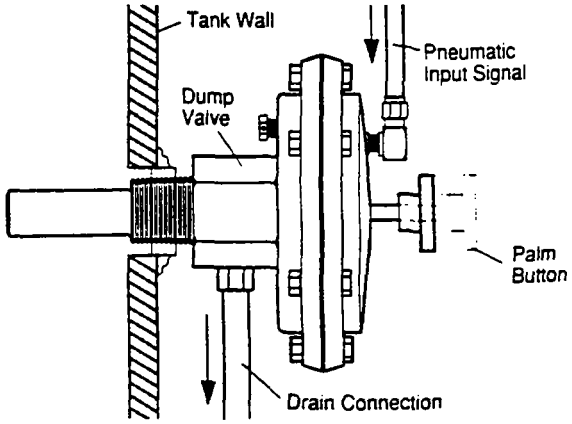
2. All pressure connections must be tight and maintained tight so as not to leak air/gas.
3. Valve seat adjustment can be made if air/gas begins to leak. Care should be taken when adjusting as only slight movement is necessary to stop the leakage; excessive force will bind the seating mechanism.



DUMP VALVE INSTALLATION

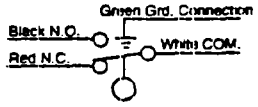
DV750 - DV1500 - DV2000

1. Screw the dump valve into the threaded connection in the lower sidewall of the vessel.
2. Position the 1/2 NPT drain connection so it is on the bottom.
3. Be sure the unit is screwed tight and does not leak liquid.
4. Install the piping for the pneumatic input signal into the 1/4 NPT threaded connection.
5. The palm button allows manual dumping of the vessel when no pneumatic signal is present.
6. Connect a drain line to the drain connection as necessary. For DV750 and DV1500 this connection is 1/2 NPT. For DV200 it is 1 NPT.



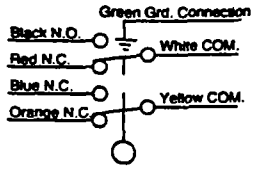
ELECTRICAL INFORMATION

SPDT (Snap Switch)



Switch Rating: 5 A @ 125-250-480 VAC
1/2 A @ 125 VDC
1/4 A @ 250 VDC
2A @ 6-30 VDC Resistive
1A @ 6-30 VDC Inductive

DPDT (Snap Switch)



Switch Rating: 10 A @ 125-250 VAC
1/2 A @ 125 VDC
1/4 A @ 250 VDC
10 A @ 6-24 VDC
Inductive/Resistive

REPLACEMENT PARTS

Order by part number designation.

L1100/L1200*

15-05-0699: *BUOYGLAS™ float*
15-05-0166: *Stainless Steel float for L1200*
15-05-0356: *Stainless Steel float for L1100*
15-00-0124: *SPDT snap switch assembly*
15-01-0213: *L1100 counter balance assembly*
15-01-0214: *L1200 counter balance assembly*

L1200N

15-05-0421: *Cam*
15-05-0699: *BUOYGLAS™ float*
15-05-0166: *Stainless Steel float for L1200N*
15-05-0453: *Valve stem*

L1200N-DVO/L1200N-DVOR

15-05-0621: *Regulator only*
05-02-0121: *20BPG 0-75 psi (0-517 kPa)*
15-01-0216: *DVO assembly*
00-00-3341: *Filter for regulator*
00-00-3340: *Regulator Diaphragm Kit*

*To maintain hazardous location listings, all other repairs must be made by the factory.

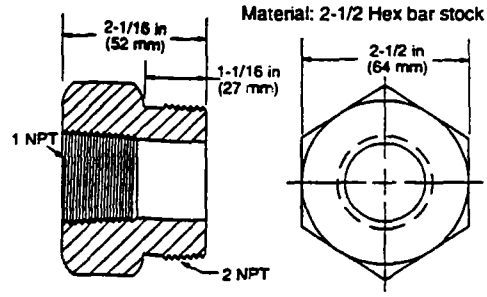
Warranty

A two year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

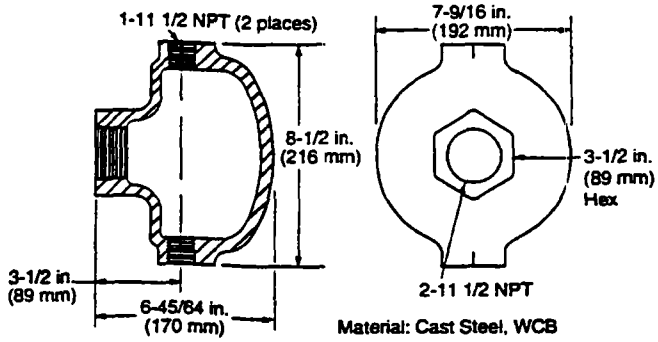
ACCESSORIES

Order by part number designation.

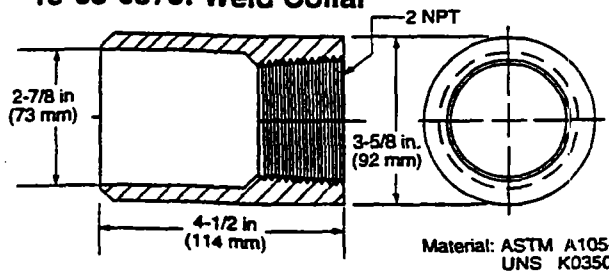
55-05-0617: DV750/DV1500 Adaptor Bushing



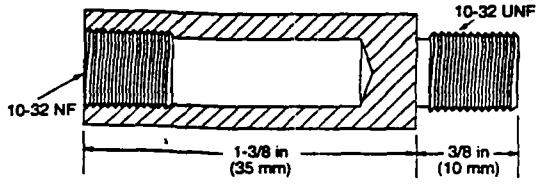
15-05-0697: External Float Chamber



15-05-0375: Weld Collar



15-05-0395: Float Shaft Extension



Material: AISI 304, UNS-S30400

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

FRANK W. murphy Since 1939 MFR

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■ **Frank W. Murphy Southern Division**
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Limited Warranty

MURPHY SWICHGAGE® and MURPHYMATIC® CONTROL SYSTEMS

Murphy SWICHGAGE® control instruments and MURPHYMATIC® control systems are warranted to be of good quality materials and workmanship. This limited warranty is for a period of two years except, items manufactured by others but sold by Murphy carry the original manufacturer's warranty. Any unit suspected of a quality flaw, verified by Murphy, will be either repaired or replaced, at our or the manufacturer's option, when returned to our factory, transportation charges paid. We are not responsible for damage caused by improper installation, neglect or abuse and are limited under warranty to repairing or replacing the parts of our manufacture and are not liable for equipment on which our controls are installed.

Murphy SWICHGAGE® control instruments, MURPHYMATIC® control systems, or their parts shall be of kind and quality described in the specifications as supplied and no other warranty except of title shall be implied. The liability of the company shall not in any case exceed the cost of correcting defects in Murphy SWICHGAGE® control instruments, MURPHYMATIC® control systems, or their parts; and upon the expiration of above mentioned two years, all such liability shall terminate. The company shall not in any event be liable for indirect or consequential damages.

You have purchased dependable instrumentation and with normal care, it will provide long and faithful service, and enhance the preventive maintenance program on your valuable equipment. Any claim for shortage or damage of this shipment must be accompanied by this Packing Slip within 15 days of receipt or invoice date, whichever is later.

Frank W. Murphy Since 1939 MFR.

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087581R Rev. 12-94

All Murphy SWICHGAGE® control instruments, MURPHYMATIC® panels and SELECTRONIC® systems are warranted to be of good quality materials and workmanship. Murphy warrants this quality for a period of TWO FULL YEARS or original manufacturer's warranty to us. (Parts and systems are code dated.) This is only a time limit extension of the standard warranty; all other statements in the Murphy Limited Warranty remain in effect.

As with any monitoring and/or control system, the purchase, installation and use of SWICHGAGE® control instruments and other Murphy Systems is NOT AN INSURANCE POLICY. It is, however, the simplest means of adding inexpensive, reliable protection. Protection that is as sound as the instruments, installation, and follow-up preventive maintenance program that is applied to these instruments and to the equipment they help protect. SWICHGAGE® control instruments, properly installed and maintained, are important and effective tools in any preventive maintenance program.

All "work machines" have life signs such as: pressures, temperatures, levels, and overspeed conditions; each of these vital signs can be monitored by a SWICHGAGE® capable of accurate indication and reliable limit switching. Teamed with Murphy electrical and SELECTRONIC® components, SWICHGAGE® control instruments can constantly monitor pressures, levels, temperatures, vibration, and overspeed conditions and activate alarm and/or shut-down when preset limits are reached. As these vital signs are constantly monitored, the SWICHGAGE® control instruments and their related components must be periodically inspected, both visually and physically. Look for frozen pointers, bad contacts, kinked or broken pressure tubing or capillaries. Check floats on Level SWICHGAGE® control instruments, mechanically, and if possibly visually. Test electric circuits and move limit contacts into the operating range to see that the proper sequence of events occurs when the contacts meet.

If a SWICHGAGE®, TATTLETALE® or other component fails the visual, physical, or electrical check, then repair or replace the unit or its parts as necessary to bring it back to proper operation. When a question exists on warranty, the questionable part should be returned to the factory or affiliate company for warranty inspection. If within the two year warranty the unit is found to operate improperly and it appears to be related to material quality or workmanship, Murphy will repair or replace the product. (See Warranty.)

Murphy SWICHGAGE® control instruments, MURPHYMATIC® panels and SELECTRONIC® systems are not a substitute for, but can be important tools in, a routine preventive maintenance program. Since 1939 we have been building our worldwide reputation as the source for simple, reliable monitoring and protection, featuring simplicity of maintenance. Please refer any questions regarding tests, repair or replacement parts to the factory, your nearest affiliate company, or your authorized servicing dealer.

Printed in U.S.A.

10.11) ROLLING STAIRS

ARROW STAR
MODEL # TBG0406E

LOUISVILLE LADDER CORP.

KIT # 998004B

THIS KIT CAN BE USED ON THE FOLLOWING MODELS.

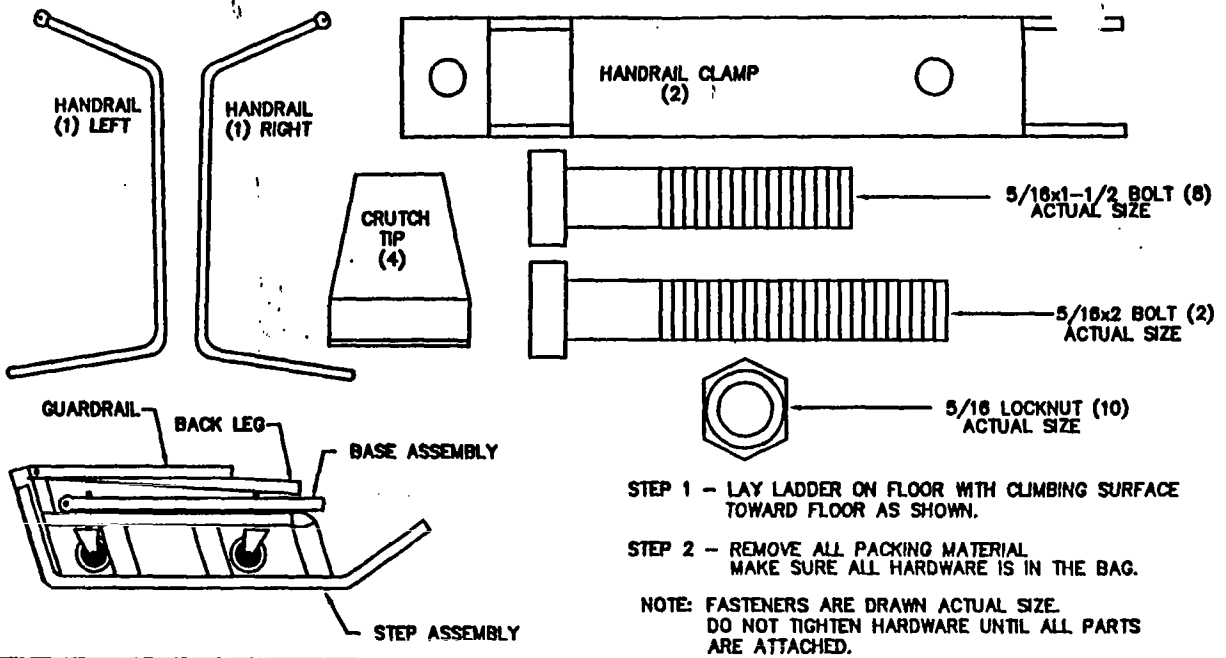
MODEL NUMBER	
SW1602-W03	SW2402-W03
SW1603-W03	SW2403-W03
SW1604-W03	SW2404-W03
SW1605	SW2405

FOLLOW INSTRUCTIONS CAREFULLY. IF FUTHER ASSISTANCE IS NECESSARY, CONTACT LOUISVILLE LADDER CORP. CUSTOMER SERVICE AT 1-800-666-2811.

LOUISVILLE LADDER CORP. 1163 ALGONQUIN PKWY. LOUISVILLE KY 40208

P/N- 993052B REV.- 0

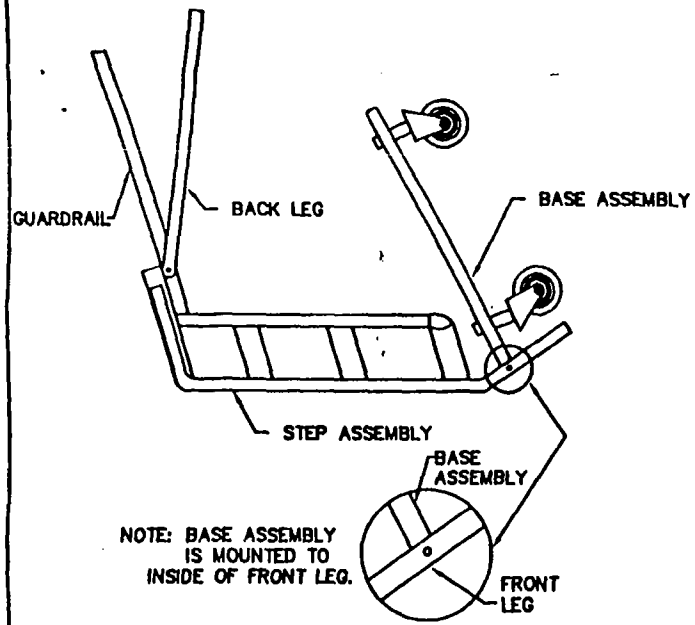
THE FOLLOWING PARTS INCLUDED IN THIS PACKAGE. PLEASE CONTACT YOUR DEALER IF ANY PARTS ARE MISSING.



STEP 1 – LAY LADDER ON FLOOR WITH CLIMBING SURFACE TOWARD FLOOR AS SHOWN.

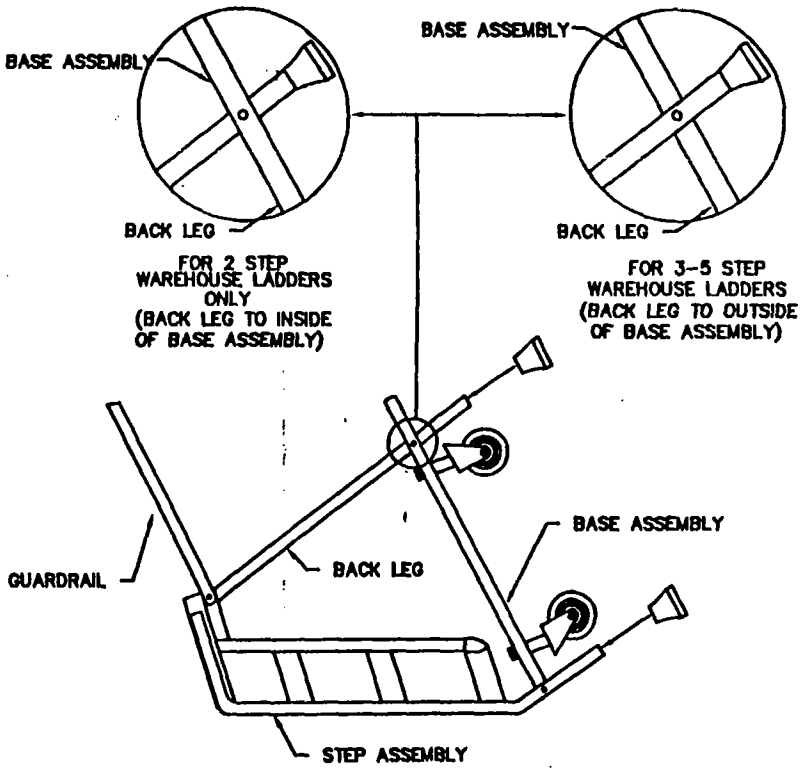
STEP 2 – REMOVE ALL PACKING MATERIAL MAKE SURE ALL HARDWARE IS IN THE BAG.

NOTE: FASTENERS ARE DRAWN ACTUAL SIZE. DO NOT TIGHTEN HARDWARE UNTIL ALL PARTS ARE ATTACHED.



STEP 3 – RAISE BACK LEGS AND GUARDRAIL OUT OF THE WAY. MOUNT THE BASE ASSEMBLY TO INSIDE OF THE FRONT LEGS OF THE STEP ASSEMBLY, USING (2) 5/16x1-1/2" BOLTS AND (2) 5/16" LOCKNUTS. (SEE DETAIL)

NOTE: MAKE SURE BASE ASSEMBLY IS MOUNTED WITH CASTERS POINTING OUTWARD.



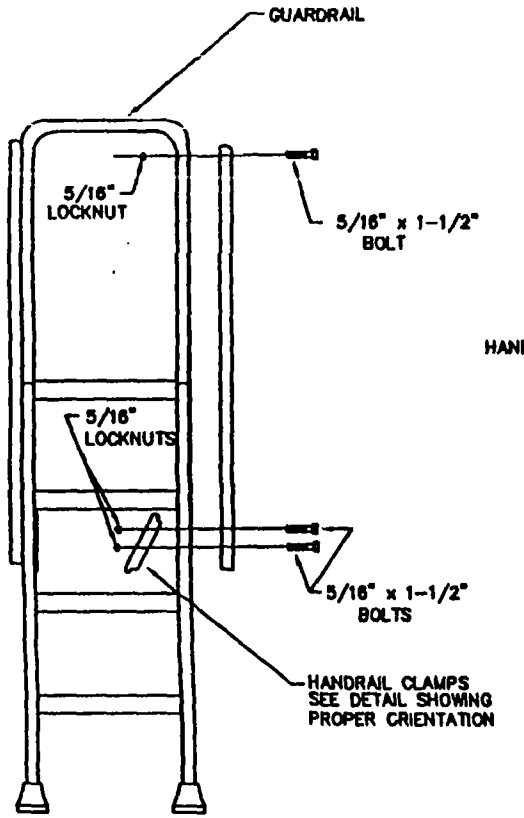
STEP 4 – MOUNT CRUTCH TIPS TO THE (4) LEGS ,MAKING SURE THEY ARE FULLY SEATED.

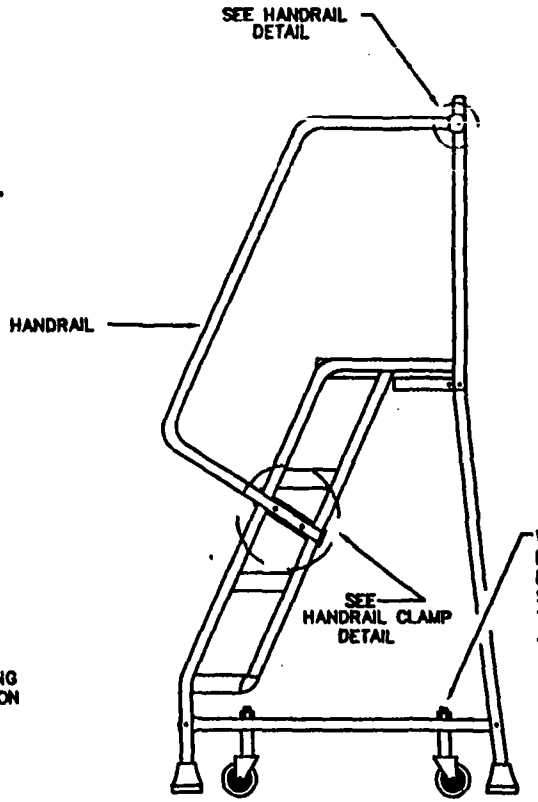
STEP 5 – ATTACH BACK LEGS TO THE BASE ASSEMBLY USING (2) 5/16x2" BOLTS AND (2) 5/16" LOCKNUTS.

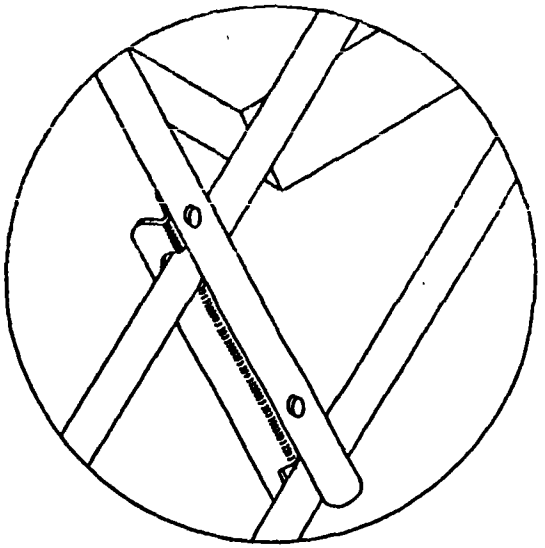
NOTE: BACK LEGS MUST BE ATTACHED TO THE INSIDE OF THE BASE ASSEMBLY, FOR 2 STEP LADDERS AND TO THE OUTSIDE OF THE BASE ASSEMBLY FOR FOR 3-5 STEP LADDERS. SEE DETAILS

STEP 6 – STAND LADDER UPRIGHT.

(OVER)

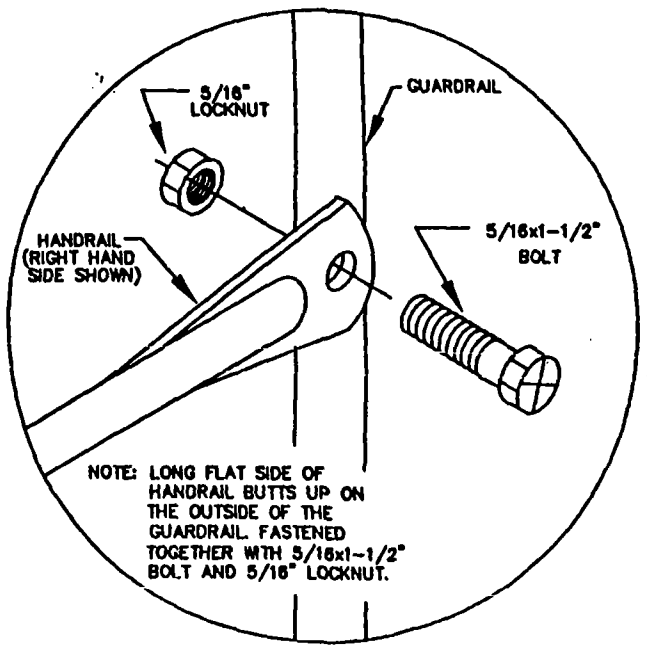






HANDRAIL CLAMP DETAIL

WHEN YOU STAND LADDER UPRIGHT IF LADDER HAS TROUBLE ROLLING YOU MAY ADJUST CASTERS BY TIGHTENING OR LOOSENING LOCKNUT ON CASTER STEM. NOTE THAT YOU MUST HAVE A MINIMUM OF 1-1/2 – 2 THREADS OF CASTER STEM PULTRUDING ABOVE LOCKNUT.



HANDRAIL DETAIL

STEP 7 – SWING GUARDRAIL TO VERTICAL POSITION.

STEP 8 – ATTACH HANDRAILS TO THE GUARDRAIL USING (1) 5/16 x 1-1/2" BOLT AND (1) 5/16" LOCKNUT. REPEAT STEP FOR OPPOSITE SIDE.

NOTE: HANDRAILS ARE TO THE OUTSIDE OF THE GUARDRAIL.

STEP 9 – ATTACH THE BOTTOM OF (1) HANDRAIL TO THE STEP ASSEMBLY USING (1) HANDRAIL CLAMP, (2) 5/16" x 1-1/2" BOLTS AND (2) 5/16" LOCKNUTS. REPEAT STEP FOR OPPOSITE SIDE

STEP 10 – TIGHTEN ALL HARDWARE EXCEPT CASTERS. SEE NOTE ON CASTERS.

10.12) CABINET

GLOBAL INDUSTRIAL EQUIPMENT
MODEL # P254760TN

edsal

storage cabinets

MODEL ~~6600~~ - 7000 - 7001 - 7005 - 7009

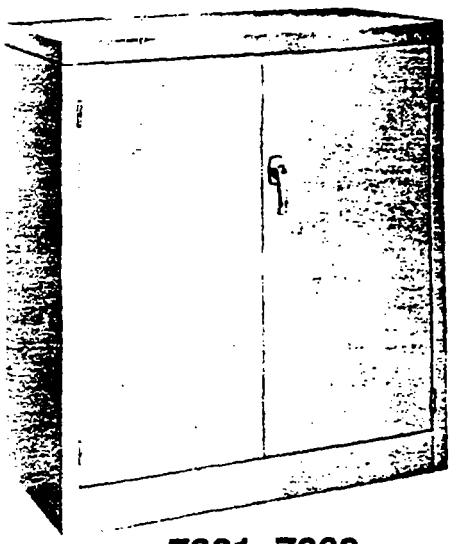
ASSEMBLY INSTRUCTIONS

TIPS FOR INSTALLER

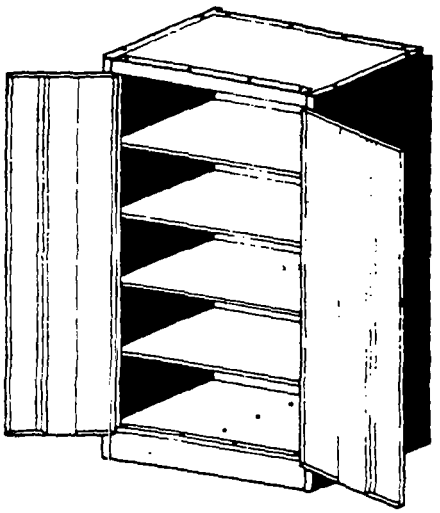
CHECK SHIPMENT: Immediately after receipt of shipment, check the condition and number of packages against the packing list and bill of lading. Any shortage or damage of packages should be noted on carrier's freight receipt. Any claim for loss or damage must be handled by the consignee, however, this company will provide any necessary assistance. Shortages or errors made by this company should be reported at once.

DISTRIBUTE MATERIALS: Check each part with parts list (page 4) as they are unpacked. Place parts in the approximate location where unit is to be assembled.

EDSAL Storage Cabinets are quality built and finished. Care should be used in handling to avoid damage.



7001, 7009

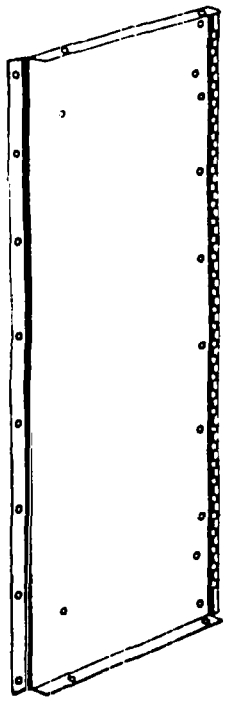


6600, 7000, 7005

EDSAL MANUFACTURING COMPANY
4400 South Packers Ave. • Chicago, Illinois 60609

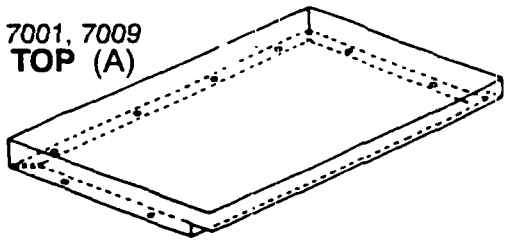
Parts for storage cabinets (also refer to Parts List on Back Page)

SPLIT-BACK (Two (2) per cabinet)

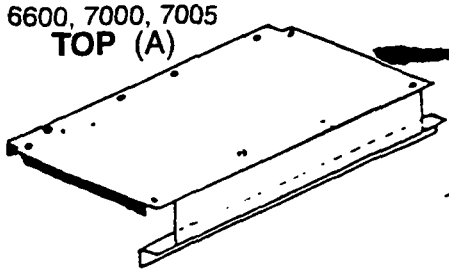


NOTE:
Illustrated is Back in right side position.

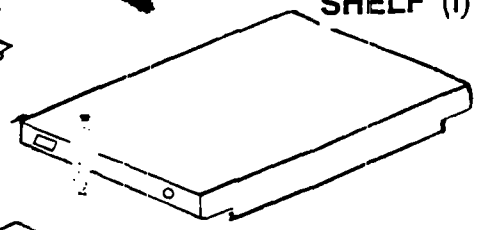
7001, 7009
TOP (A)



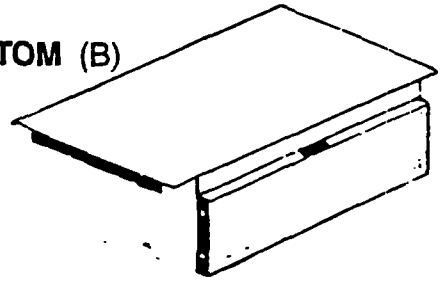
6600, 7000, 7005
TOP (A)



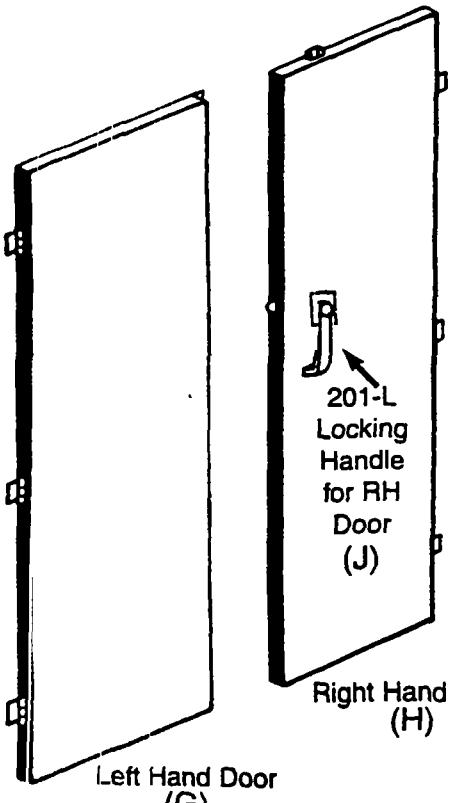
SHELF (I)



BOTTOM (B)

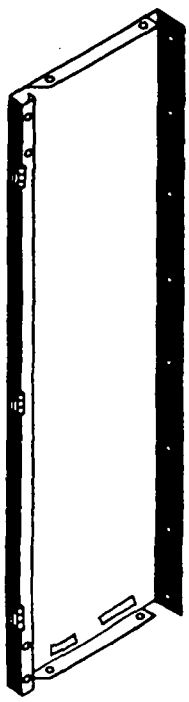


DOORS

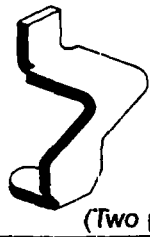


CABINET SIDES Left Hand (D)
Right Hand (E)

(Left Side Shown)

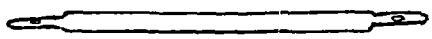


SHELF BRACKET (K)



(Two per shelf)

DOOR RODS (2) (F)



BOLTS & NUTS

#10-24 X 3/8" Bolt & Nut
(L) (M)

1/4-20 x 1/2" Bolt & Nut
(N) (O)

Assembly Instructions

Note: Before tightening hardware, check for squareness.

Place two Split-Backs on horse or other support for elevation. (By taking one of the two Backs and turning upside down, you have both a right and left Split-Back). The offset edge of right Split-Back should overlap offset edge of left Split-Back. The two Backs should now be bolted with #10-24 x 3/8" bolts and nuts. (see figure A)

2. The Top is now put into position **Under** top flanges of back and sides. Using #10-24 x 3/8" bolts, attach Top to Back by bolting through from flange side. (see figures B & C)

3. Next, bolt the right and left Cabinet Sides to right and left Back edges and to the top. Use #10-24 x 3/8" bolts. Top flange of Cabinet Side should be over Cabinet Top. (see figures A & B)

4. Position Bottom flange of Top through the slot located on the Cabinet Sides. (see figure B)

5. Position Cabinet Bottom between Front edges of Cabinet Sides at Lower End and Bolt with four 1/4 - 20 x 1/2" bolts. (see figures B & D)

6. Position Cabinet Bottom and attach to Back and Base with #10-24 x 3/8" bolts. (see figures B & C)

7. Hang right and left hand Doors to the Split-Hinges welded to the Side. (See figure A)

8. Unit may now be set upright. To install shelf first insert Shelf Brackets in the adjustment slots located in the front edges of the Cabinet Ends. Now insert rear corners of shelf in shelf adjustment slots located at either end of back. The front corners of Shelf rest on and are supported by the Shelf Brackets. (see figure C). Direct the square cutout on the side of the Shelf to the rear of the cabinet.

9. Install 3 Point Locking Handle on right side door, following carefully instructions included in handle hardware package (note that Locking Handle is used with 2 locking bars.)

10. To insure that the doors will operate properly, **PLACE THE CABINET IN ITS PROPER POSITION AND PLACE SHIMS UNDER THE CORNERS, WHERE REQUIRED, SO THE UNIT WILL BE LEVEL.**

FIGURE A

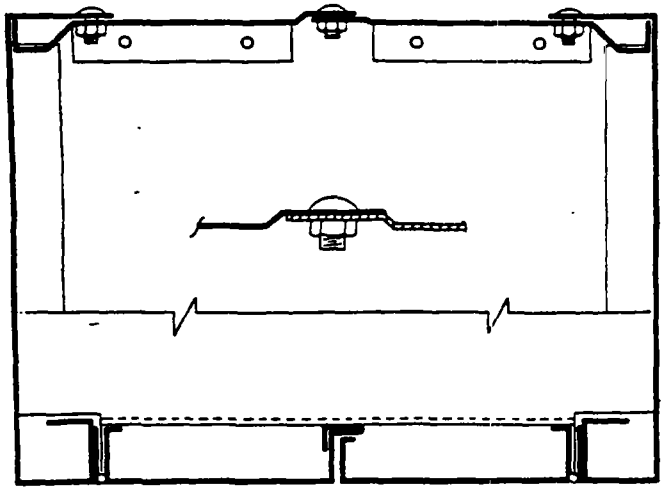
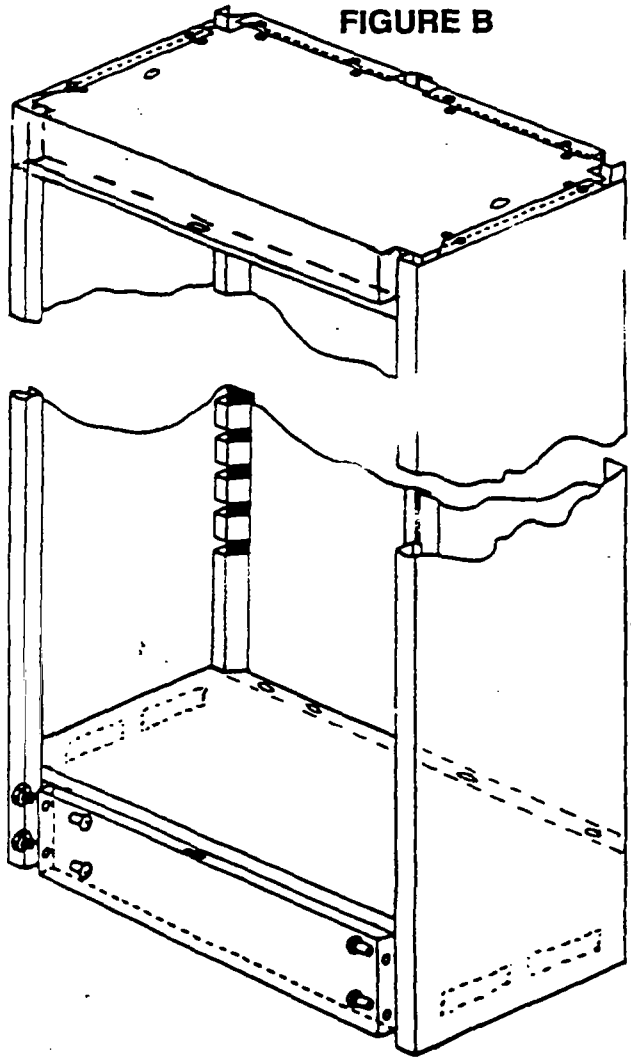


FIGURE B



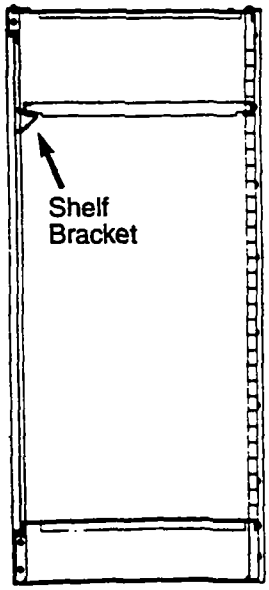


FIGURE C

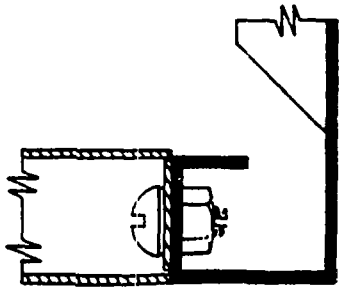


FIGURE D

PARTS LIST FOR CABINETS 6600, 7000, 7001, 7005, 7009

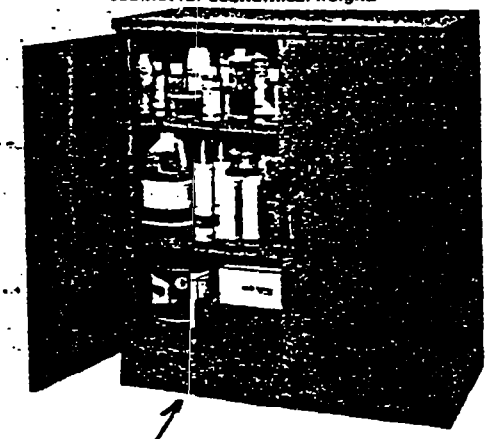
		6600 Cabinet 15x30x66 Storage		7000 Cabinet 18x36x72 Storage		7001 Cabinet 18x36x42 Storage		7005 Cabinet 24x36x72 Storage		7009 Cabinet 18x36x42 Set-Up Storage	
Ref. Ltr.	Part Name	Part Number	Qty.	Part Number	Qty.	Part Number	Qty.	Part Number	Qty.	Part Number	Qty.
A	Top	4031	1	4006	1	4075	1	[illegible]7	1	4075	1
B	Bottom	4083	1	4030	1	4030	1	[illegible]81	1	4030	1
C	Back	1010	2	1008	2	1053	2	1008	2	1053	2
D	LH Side	2067	1	2024	1	2026	1	2033	1	2026	1
E	RH Side	2040	1	2025	1	2027	1	2034	1	2027	1
F	Door Rods	9989	2	9990	2	9988	1	9990	2	9988	1
G	Door LH	3019W	1	3017W	1	3004W	1	3017W	1	3004W	1
H	Door RH	3020W	1	3018W	1	3003W	1	3018W	1	3003W	1
I	Shelf	5098	4	5100	4	5100	2	5101	4	5100	2
J	Locking Handle	201L	1	201L	1	201L	1	201L	1	201L	1
K	Shelf Bracket	7000CLP	8	7000CLP	8	7000CLP	4	7000CLP	8	7000CLP	4
L	#10-24x3/8" Unslt Bolt	F102438S	30	F102438S	30	F102438S	24	F102438S	32	F102438S	
M	#10-24 Nut	F1024N	30	F1024N	30	F1024N	24	F1024N	32	F1024N	
N	1/4 - 20-1/2" Bolt	F14205S	4	F14205S	4	F14205S	4	F14205S	4	F14205S	
O	1/4 - 20 Nut	F1420N	4	F1420N	4	F1420N	4	F1420N	4	F1420N	
P	Door Rod Guides	DBG3000S	2	DBG3000S	2	DBG3000S	2	DBG3000S	2	DBG3000S	2
	(Door Rod Guides are Previously Assembled to the Right Hand Door)										

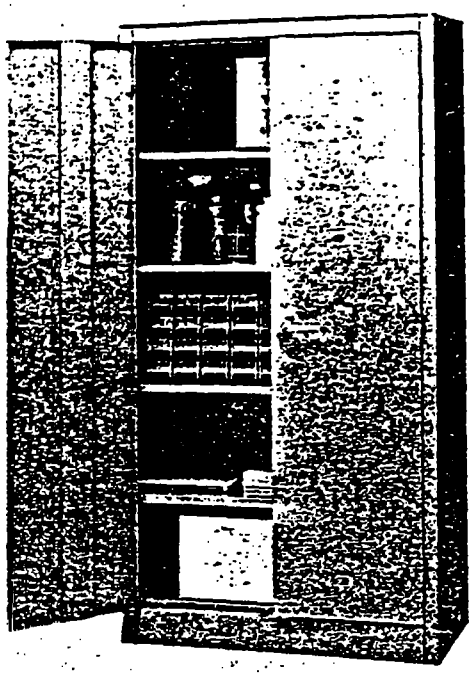
10.13) FOOT LOCKER

NORTHERN HYDRAULICS
MODEL # 334291-F459

INDUSTRIAL QUALITY
STEEL CABINETS

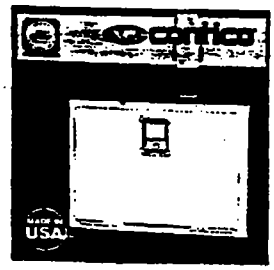
Built rugged for factory or warehouse with a streamlined design that's attractive enough for your office. Heavy gauge steel construction throughout ensures superior strength, precise alignment and long, dependable service. Shelves adjust easily, allowing maximum storage flexibility. You'll be amazed at the amount of material you can store...tools, valuable raw materials, office supplies and more. Top quality three point locking device guards against pilferage. Choose ready-to-use Set-Up cabinet or Knocked-Down cabinet for economical freight.





SIZE: 30" WIDE x 15" DEEP x 66" HIGH

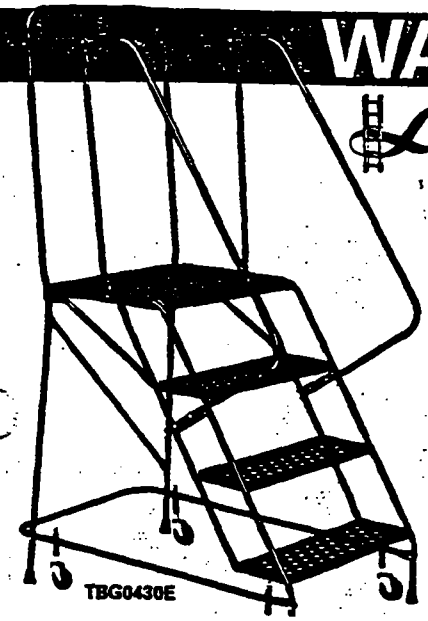
Heavy Duty Underbody Truck Box Adds Plenty of Storage



Holds lots of gear! Mounts underneath the bed of larger trucks or to the side of any pickup bed. 12-gauge steel door has a stainless steel paddle-handle lock and a heavy duty door chain. Built-in rain gutter surrounds door to keep the elements out. Corrosion-resistant finish inside and out. U.S.A.

NORTHERN HYDRAULICS
MODEL # 334291-F459
INSIDE DIMENSIONS: 36" LONG x 18" DEEP x 18" HIGH
MOUNTED UNDER STEEL CABINET

WAREHOUSE SPECIALS



TBG0430E

Louisville ROLLS TO THE JOB QUICKLY & EASILY

IN STOCK 24 HOUR SHIPMENT*

STEP UP TO SAVINGS! SAVE UP TO 15%! OFFER ENDS 9/6/96

Stock No.	Step	Ht. to Top Step	Step W"	Base Dim. W" x D"
10" DEEP TOP STEP LADDERS WITHOUT HANDRAILS				
TBG0450E	1	12	16	18 x 15
TBG0402E*	2	20	16	20 x 19
TBG0404E*	3	30	16	20 x 26
10" DEEP TOP STEP LADDERS WITH 30" HIGH HANDRAILS				
TBG0406E*	4	40	16	20 x 32
TBG0451E*	5	50	16	20 x 39
TBG0408E*	5	50	24	30 x 39
20" DEEP TOP STEP LADDERS WITHOUT HANDRAILS				
TBG0448E*	1	12	16	18 x 25
TBG0426E	2	20	16	20 x 29
TBG0428E*	3	30	16	20 x 36
20" DEEP TOP STEP LADDERS WITH 30" HIGH HANDRAILS				
TBG0430E*	4	40	16	20 x 42
TBG0453E	5	50	16	20 x 49
TBG0432E*	5	50	24	30 x 49

INDUSTRIAL ROLLING STEP LADDER for your parts department, warehouse, stockroom or office. Steel construction assures long, trouble-free service. All ladders have 7" deep perforated non-slip steps, and rubber-tipped feet for greater stability and non-skid safety. Spring-loaded casters retract automatically under individual's weight, permitting rubber feet to engage floor. Prevents ladder from rolling or shifting.

See pages 50-51 for other ladders.

10.14) ELECTRICAL

GENERAL ELECTRIC, DRY TYPE GENERAL PURPOSE TRANSFORMER, TYPE QMS3, 15 KVA
HOFFMAN ENCLOSURE, MODEL # A-363010LP
SQUARE "D" LOAD CENTER, 125 AMP
SIGNALINE TIMER, 36X SERIES TIMER DELAY RELAY
ALLEN-BRADLEY, TYPE N, AC RELAY
WARRICK LEVEL CONTROL, MODEL # 1G2D4
ALLEN-BRADLEY, TYPE PK, MASTER CONTROL RELAY
ALLEN-BRADLEY, ON/OFF SWITCH, MODEL # 800H-HR2A
ALLEN-BRADLEY, HAND/OFF/AUTO SWITCH, MODEL # 800H-JR2A
ALLEN-BRADLEY, RESET BUTTON, MODEL # 800H-AIA
ALLEN-BRADLEY, PILOT LIGHT, MODEL # 800T-Q10G
ALLEN-BRADLEY, PILOT LIGHT, MODEL # 800T-Q10R
MARLEY ELECTRIC HEATER, MODEL # UH-524TA
FLASHING LIGHT, EDWARDS MODEL # 52A-N5-40W
DAYTON HEAVY DUTY RING FRAME FAN, MODEL # 2C100C
DAYTON INTAKE GUARD, MODEL # 4C545
STONCO LIGHT

DRY-TYPE GENERAL PURPOSE TRANSFORMERS

TYPE ML, QM, QMS AND QMS 3

RECEIVING

Upon receipt examine the package for any damage that may have occured in shipment. If the shipping container must be opened outdoors, take proper precautions to prevent the entrance of moisture. Examine the transformer for broken, bent or loose parts, or other damage. If damage from outside sources is evident, file a damage claim with the transportation company and notify the nearest General Electric sales representative.

HANDLING AND STORAGE

Units having a net weight in excess of approximately 50 pounds have a provision for lifting. For lifting type QMS and QMS 3 transformers two one-inch diameter holes are provided at the top of the mounting bracket.

The storage rooms should be clean and dry and without extreme temperature variations. Before placing the transformer in service after a period of storage, be sure that it is clean and dry by observing the instructions under "installation".

INSTALLATION

PREPARATION

Any accumulation of dirt or dust may be removed by brushing or by blowing dry air on the unit. If mositure is evident by feel or appearance, the unit should be dried by placing it in an oven or by blowing heated air over it until dry. In either case the temperature should not exceed 110°C (230°F).

MOUNTING

The only foundation necessary is a flat vertical surface or wall strong enough to support the weight of the unit. Regardless of the type of mounting surface, permanent and effective grounding of the metal case is recommended as a safety precaution. Free circulation of air is essential for the proper operation of all dry type transformers; therefore, a minimum distance to adjacent structures of six inches is required. Type QM, QMS and QMS 3 transformers must be mounted upright with the wiring compartment at the bottom. Type ML units can be used indoors or outdoors. They mount upright or horizontally indoors; upright only outdoors.

All general purpose dry type transformers are cooled by free circulation of surrounding air over their surfaces. In the totally enclosed, non ventilated designs all heat is transferred by the exterior surfaces. These transformers will perform satisfactorily at their rated output when surrounding air does not exceed 40°C (104°F) and adjacent structures do not impede free movement of air.

CONNECTIONS

Reference should be made to the wiring diagram and/or nameplate when making electrical connections to the transformer. *Do not change connections while the unit is energized.* To minimize circulating currents in the enclosure all leads to the same load must pass through one knockout and all supply leads must pass through one knockout.

Make certain that all connections are electrically tight so that current-carrying parts are joined under adequate pressure. If aluminum cable is used, adequate preparation of the aluminum cable and protection of the joint is essential.

Type ML general purpose transformers meet Underwriters Laboratories requirement for use with 75C connecting cables, while QM, QMS and QMS 3 transformers meet the requirements for use with 90C connecting cables.

To protect dry-type transformers from voltage surges imposed upon the lines by lightning, switching, or other sources, adequate surge protection devices should be connected near any transformer exposed to such overvoltages.

General purpose transformers may also be connected as autotransformers for boosting or bucking voltage. However the use of autotransformers is subject to precautions: secondary circuits supplied by autotransformers may be subject to exceptionally severe short circuit currents unless protected by current-limiting means. It is recommended that suitable current-limiting devices be installed, where necessary, to limit the short-circuit current to 25 times the rated current. In all cases the National Electrical Code regulations should be followed.

MAINTENANCE

Dry-type transformers have no moving parts. The only maintenance required is periodic inspection of connections and removal of accumulated dust and dirt.

Additional information relating to the installation and maintenance of general purpose transformers can be found in the American National Standards Institute publication C57-94. "Guide for Installation and Maintenance of Dry-Type Transformers".

RENEWAL PARTS

Because of the unit structure of these transformers, field repairs are usually uneconomical and no spare parts and renewal parts are recommended. If conditions of operation dictate the need for standby equipment, a complete spare unit is recommended.

DESCRIPTION

Type QM, QMS, QMS 3 and Type ML general purpose transformers reflect different types of construction per Figs. 1 and 2 below. All units are designed for wall mounting and for ratings of 600 volts or below. They are suitable for outdoor as well as indoor service.

General purpose transformers are designed to reach rated temperature rise above ambient air temperature when operating continuously at rated voltage, frequency and load. Serious overheating with possible fire damage may result if the unit is operated for sustained periods at "above" rated voltage, "above" rated current,* or at "lower" than rated frequency.

*Rated current equals volt-amperes divided by rated voltage for single-phase units; or for three-phase units, rated volt-amperes divided by rated line-to-line volts, the total of which is divided by the square root of three...1.732.

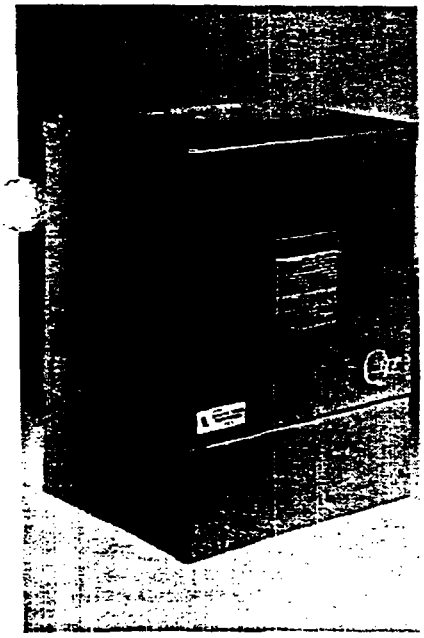


Fig. 1 Type QMS, enclosed construction with single-phase ratings, 5 – 25kVA (Supersedes previous Type QM)

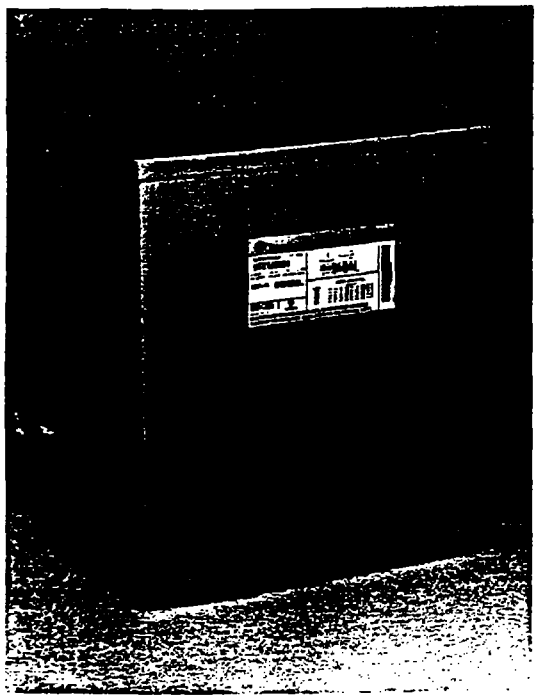


Fig. 2 Type QMS 3, enclosed construction with three-phase ratings, 3 – 15kVA (Supersedes previous Type ML)

GENERAL ELECTRIC COMPANY
SPECIALTY TRANSFORMER DEPARTMENT
FORT WAYNE, INDIANA 46804

475A484AAP006 7/94

Hoffman Engineering Company
900 Ehlen Drive
Anoka, Minnesota, 55303-7054, U.S.A.
Phone(612)421-2240 Fax(612)421-1556

INSTRUCTIONS

HOFFMAN CANNOT ASSURE THE SAFETY OR EFFECTIVENESS OF ANY ALTERATIONS OR ADDITIONS NOT MADE BY US. HOWEVER, THE FOLLOWING INFORMATION MAY BE HELPFULL. THESE INSTRUCTIONS DO NOT ELIMINATE THE NEED TO CONSULT WITH EQUIPMENT MANUFACTURERS AND TO OBSERVE ALL REGULATORY AGENCY PROCEDURES AND SAFE PRACTICES TO ASSURE THE PROPER ELECTRICAL AND MECHANICAL FUNCTION OF HOFFMAN PRODUCTS IN EACH PARTICULAR APPLICATION.

1. REPAINTING

SEE "INSTRUCTIONS FOR REPAINTING HOFFMAN STANDARD PAINT FINISHES",PART NUMBER 23155-002.

2. MOUNTING INSTRUCTIONS

A. WALL MOUNTED ENCLOSURES HAVE EITHER A INTERNAL MOUNTING MEANS OR INTERNAL MOUNTING FEET.PROPER FASTENERS MUST BE USED IN ALL MOUNTING HOLES TO SECURE THE ENCLOSURE TO THE WALL.

B. FLOOR MOUNTED ENCLOSURES HAVE FLOOR STANDS (LEGS) WHICH INCLUDE MOUNTING PLATES.PROPER FASTENERS MUST BE USED IN ALL MOUNTING HOLES TO SECURELY ANCHOR THE ENCLOSURE TO THE FLOOR.

3. DOOR CLOSING ADJUSTMENTS

SINGLE DOOR (WALL MOUNTED)
IF THE SURFACE ON WHICH THE ENCLOSURE IS MOUNTED IS NOT FLAT, THE DOOR MAY NOT OPEN AND CLOSE PROPERLY. ALSO,IF HEAVY EQUIPMENT IS MOUNTED ON A LARGE DOOR, THE DOOR MAY SAG SLIGHTLY, IF THE TOP OF THE DOOR STRIKES THE LIP WHICH EXTENDS AROUND THE BODY OPENING, PLACE METAL SHIMS BEHIND THE MOUNTING FOOT WHICH IS LOCATED AT THE BOTTOM OF THE ENCLOSURE AND CLOSEST TO THE DOOR HINGE. PLACE THE SHIMS BETWEEN THE MOUNTING FOOT AND THE WALL OR MOUNTING SURFACE. BE SURE ALL MOUNTING SCREWS ARE TIGHTENED SECURELY.

B.TWO DOOR (FLOOR MOUNTED)
THE OVERLAPPING DOORS ARE FACTORY-FITTED TO MEET EVENLY AT THE TOP AND BOTTOM. IF THE FLOOR UNDER THE ENCLOSURE IS NOT LEVEL, THE DOORS WILL NOT CLOSE EVENLY. IN THIS CASE, PLACE METAL SHIMS UNDER THE CORNERS OF THE ENCLOSURE. THE ENCLOSURE SHOULD BE BOLTED IN PLACE WITH THE DOORS CLOSED TO PREVENT TIPPING WHEN INSTALLING SHIMS. SHIMS UNDER THE RIGHT FRONT CORNER WILL RAISE THE RIGHT DOOR. SHIMS UNDER THE LEFT FRONT CORNER WILL RAISE THE LEFT DOOR. IT IS IMPORTANT THAT THE DOORS MEET EVENLY TO INSURE A PROPER SEAL AGAINST LIQUIDS AND DUST. BE SURE ALL MOUNTING BOLTS ARE TIGHTENED SECURELY.

4. PANEL INSTALLATION

WHEN THE INTERIOR PANEL IS BEING INSTALLED, IT MAY BE NECESSARY TO BEND ONE OR MORE MOUNTING STUDS SLIGHTLY TO PERMIT THE PANEL TO FIT IN PLACE. SIMPLY POSITION THE PANEL ON THE STUDS THAT LINE UP PROPERLY, AND PRY THE OTHER STUDS INTO POSITION WITH A SUITABLE SCREWDRIVER INSERTED THROUGH THE PANEL HOLES.

5. REMOVING HINGE PINS FROM CONTINUOUS HINGES

THIS IS A DIFFICULT OPERATION, REQUIRING AT LEAST 2 PEOPLE, AND IS BEST ACCOMPLISHED BY USE OF A SMALL-DIAMETER PUNCH TO DRIVE THE HINGE PIN TOWARD THE BOTTOM OF THE ENCLOSURE. WHEN THE HINGE PIN PROTRUDES ABOUT 2 INCHES BELOW THE BOTTOM HINGE BARREL, BEND THE END OF THE PIN 180° SO IT IS SHAPED LIKE THE LETTER "J". USE AN ELECTRIC OR AIR POWERED VIBRATING HAMMER FITTED WITH A TOOL WHICH HAS A HOLE IN THE END TO FIT OVER THE HINGE PIN, AND DRIVE THE HINGE PIN OUT WHILE OPENING AND CLOSING THE DOOR. TO INSTALL THE HINGE PIN, STRAIGHTEN THE PIN AND DRIVE IT IN WITH THE VIBRATING HAMMER WHILE OPENING AND CLOSING THE DOOR. MOST HINGE PINS HAVE ONE END CHAMFERED. BE SURE TO START THE CHAMFERED END FIRST WHEN INSTALLING THE PIN.

6. PRINT POCKET

THE PRINT POCKET ON THE DOOR CAN BE INVERTED, OR CAN BE REMOVED ENTIRELY.

7. LIFTING ENCLOSURES WHICH HAVE EYEBOLTS

TO LIFT AN ENCLOSURE WHICH HAS EYEBOLTS OR MOUNTING FEET, BE SURE TO USE ALL OF THE EYEBOLTS AND TOP MOUNTING FEET PROVIDED. ARRANGE THE CHAINS AND CABLES WITH SPREADER BARS, ETC., SO YOU ARE LIFTING STRAIGHT UP ON THE EYEBOLTS OR TOP MOUNTING FEET.

ACCESSORIES AND HARDWARE

H FMAN CANNOT ASSURE THE SAFETY OR EFFECTIVENESS OF ANY ALTERATIONS OR ADDITIONS NOT MADE IN ITS PLANT.

LOCK KITS AND LATCH KITS ARE AVAILABLE FOR FIELD OR FACTORY INSTALLATION ON MANY TYPES OF HOFFMAN ENCLOSURES. LOCKKITS PROVIDE KEY-LOCKING CAPABILITIES. LATCH KITS PERMIT RAPID ACCESS TO ENCLOSURE INTERIORS WHILE RETAINING THE OILTIGHT AND DUST TIGHT FEATURES.

LOUVER PLATE KITS PROVIDE VENTILATION IN ENCLOSURES WHERE INTERNAL HEAT IS A PROBLEM.

FLOOR STAND KITS FOR CONVERTING WALL MOUNTING ENCLOSURES TO FLOOR MOUNTING ARE AVAILABLE FOR FIELD OR FACTORY INSTALLATION ON SINGLE DOOR NEMA 12 AND NEMA 4 ENCLOSURES.

DRIP SHIELD KITS ARE AVAILABLE FOR FIELD OR FACTORY INSTALLATION ON SINGLE DOOR AND DOUBLE DOOR NEMA 12 ENCLOSURES.

ELECTRICAL INTERLOCKS PROVIDE A POSITIVE INTERNAL SAFETY LOCKOUT ON ELECTRICAL ENCLOSURES WHILE THE ENCLOSURE CONTENTS ARE ENERGIZED.

SWING OUT PANEL KITS PROVIDE A MEANS OF MOUNTING GAUGES,SWITCHES,PILOT LIGHTS AND OTHER COMPONENTS NEAR THE FRONT OF THE ENCLOSURE.

SAFETY LOCKOUTS PROTECT PERSONNEL AND EQUIPMENT BY ENABLING MULTIPLE PADLOCKS TO BE INSTALLED ON A DE-ENERGIZED SWITCH.

TOUCH UP PAINT IS USED TO REPAIR THE FINISH OF ENCLOSURES AND PANELS.

ENCLOSURE STABILIZERS PROVIDE STABILITY TO FLOOR MOUNTED ENCLOSURES WHICH ARE NOTBOLTED TO THE FLOOR.

WINDOW KITS ARE AVAILABLE FOR MANY TYPES OF HOFFMAN ENCLOSURES.

CORROSION INHIBITORS PROTECT INTERIOR COMPONENTS OF ENCLOSURES, WIREWAY, CONSOLES, ETC. FROM CORROSION. THERE ARE NO COATINGS, OILS, OR GREASES TO APPLY.

HOLE SEALS ARE USED TO SEAL EXTRA CONDUIT OPENINGS,PUSHBUTTON HOLES, CUTOUTS, ETC. AGAINST DUST,DIRT,OIL AND WATER.

TERMINAL KIT ASSEMBLIES PROVIDE AN EASY METHOD TO MOUNT TERMINAL BLOCKS IN MANY TYPES OF HOFFMAN ENCLOSURES.

FOLDING SHELVES CAN BE USED TO SUPPORT INSTRUMENTS AND TEST EQUIPMENT.

PEDESTALS ARE USED TO PROVIDE FLOOR MOUNTING AT A WORKING HEIGHT FOR SMALL TO MEDIUM SIZE ENCLOSURES.

OTHER HOFFMAN PRODUCTS

- NEMA 1,NEMA 3R,NEMA 4, NEMA 4X, NEMA 9, AND NEMA 12 ENCLOSURES
- OIL TIGHT JIC BOXES AND TROUGHS
- OIL TIGHT WIREWAY AND LAY-IN WIREWAY
- NEMA 1 WIREWAY
- OIL TIGHT PUSHBUTTON ENCLOSURES
- CUTOUT BOXES,PULL BOXES,AND TRANSFORMER CABINETS
- ..ON-METALLIC ENCLOSURES
- STAINLESS STEEL ENCLOSURES AND BOXES
- ALUMINUM ENCLOSURES AND BOXES
- CONSOLE CABINET
- CUSTOM-BUILT ENCLOSURES OF ALL TYPES
- INSTRUMENT AND ELECTRONIC ENCLOSURES
- ENVIRONMENTAL CONTROL PRODUCTS
- EMI/RFI SHIELDED ENCLOSURES
- WIRING DUCT

SQUARE D
Instruction Bulletin
ENGLISH
40271-419-02
5/96
Lexington, KY, USA

QO® and HOMELINE® Load Centers

INTRODUCTION

This bulletin contains instructions for the installation and operation of QO and HOMELINE load centers manufactured by Square D.

⚠ DANGER

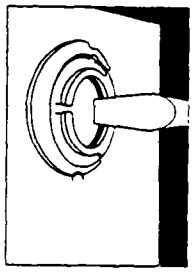
HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

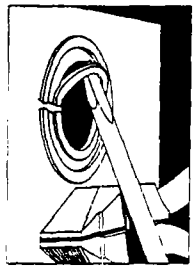
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Do not allow petroleum-based paints, solvents, or sprays to contact the nonmetallic parts of this product.
- Before starting a wiring installation or addition, consult a local building or electrical inspector for current National Electrical Code requirements. Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.

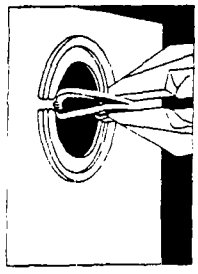
Failure to follow these instructions will result in death or serious injury.

PREPARATION

1. Determine the wiring or conduit requirements for the main and branch circuits, as required by local electrical codes.
2. Select the proper cable clamp, or use other approved methods for securing the cable or conduit to the enclosure.
3. Remove the appropriate knockouts required for installation of cable clamps or conduit. To remove knockouts:





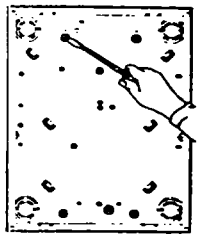


Bolt-on Conduit Hubs for Outdoor Load Centers (order separately)

Conduit	Hub No.
3/4 in.	B-075
1 in.	B-100
1-1/4 in.	B-125
1-1/2 in.	B-150
2 in.	B-200
2-1/2 in.	B-250

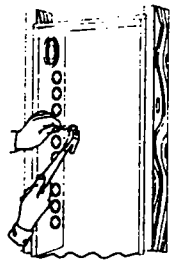
BOX MOUNTING

Surface Mounting
(Indoor or Outdoor)



Fasten the box to the wall with screws or nails. Use all pre-cut holes in the back of the box.

Flush Mounting (Indoor Box Only)



a. Remove the small mounting knockouts on the side of the box.

b. Position the load center so front edge of enclosure is flush with **finished** wall.

c. Nail or screw through the small knockouts on the enclosure sides.

MAIN CIRCUIT BREAKER OR MAIN LUG WIRING

1. Pull the conductors into the box.

   Use approved wire clamps, conduit bushings, or other approved methods to secure the conductor to the box and prevent damage to the conductor insulation.

2. Connect the main and neutral wires.
   a. Install the main and neutral wires according to load center wiring diagram.
   b. Connect the service ground, equipment grounding wire, or both as required by local electrical code.
   c. Torque each connection to the value specified on the load center wiring diagram attached to the box.
3. If required by local code, install the enclosed green neutral bonding screw through the hole in the neutral bar. Thread the screw into the hole in the box and torque to the value specified on the card shipped with the bonding screw.

BRANCH CIRCUIT BREAKER INSTALLATION AND REMOVAL

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Use only Square D Company circuit breakers and accessories.

Use of other components voids the warranty may void the UL Listing, and can result in property loss or personal injury.

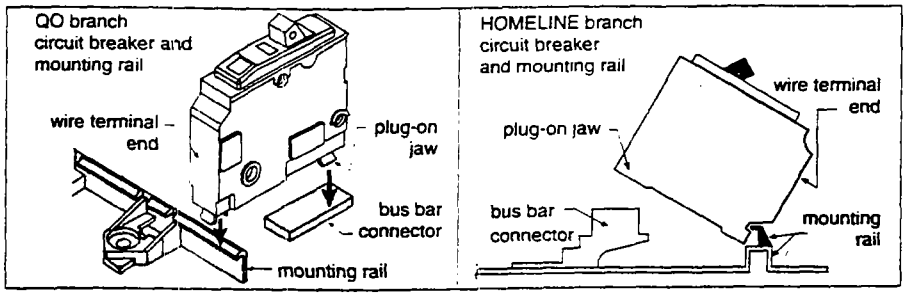
Standard Branch Circuit Breakers
Installation

1. Determine the wiring or conduit requirements for the branch circuit.
2. Turn OFF the circuit breaker.
3. Install the wire terminal end of the circuit breaker onto the mounting rail and push inward until the plug-on jaw fully engages the bus bar connector. Keep the bottom of the circuit breaker case against the mounting rail.
4. Remove the wire insulation from the branch wire as required. Install the branch wire into the load terminal of the branch circuit breaker.
5. Torque each branch circuit breaker connection to the value specified on the circuit breaker.
6. Torque each neutral and ground connection to the value specified on the load center wiring diagram attached to the box.

Standard Branch Circuit Breakers (cont.)

Removal

1. Turn OFF the circuit breaker. Remove the wires.
2. To disconnect the plug-on jaw from the connector and mounting rail, pull the circuit breaker outward until it disengages from the mounting rail.



Tandem Branch Circuit Breakers

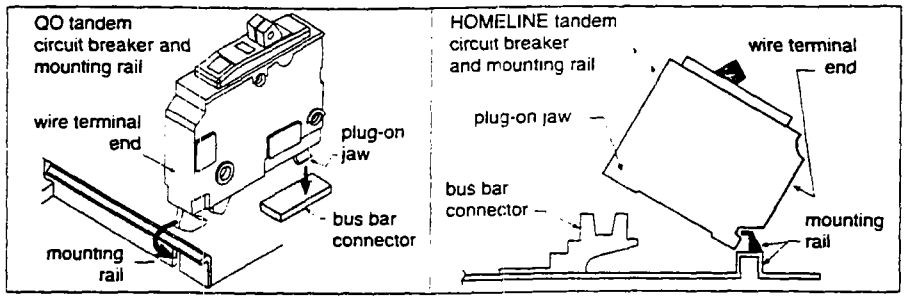
Installation

Install QOT and HOMT tandem-type circuit breakers only in single-phase load centers. **Refer to the wiring diagram on the load center for installation location.**

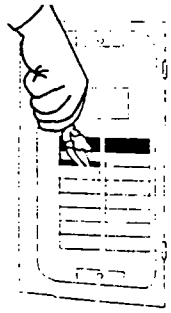
1. Determine the wiring or conduit requirements for the branch circuit.
2. Turn OFF the circuit breaker.
3. Hold the tandem circuit breaker at a 30°– 45° angle.
4. Install the wire terminal end of the circuit breaker into the mounting rail.
5. Rotate the circuit breaker inward until the plug-on jaw fully engages the bus bar connector. Keep the bottom of the breaker case against the mounting rail.
6. Remove the wire insulation from the branch wire as required. Install the branch wire into the load terminal of the branch circuit breaker.
7. Torque each branch circuit breaker connection to the value specified on the circuit breaker.
8. Torque each neutral and ground connection to the value specified on the load center wiring diagram attached to the box.

Removal

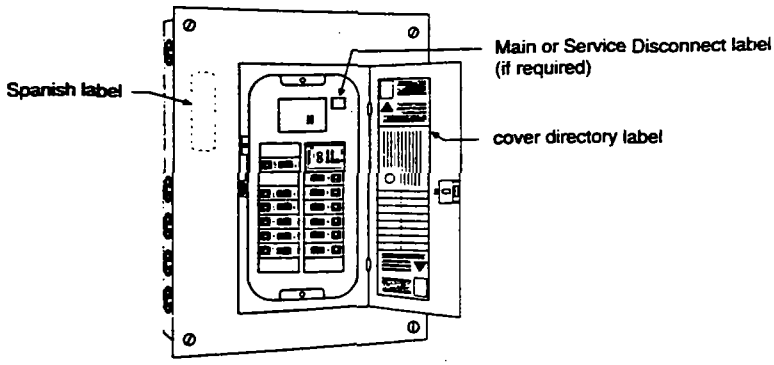
1. Turn OFF the circuit breaker. Remove the wires.
2. To disconnect the plug-on jaw from the connector, pull the circuit breaker outward until it disengages from mounting rail.



INSTALLING THE COVER



1. Remove the cover twistouts.
   a. Remove only enough twistouts to match the number of circuit breakers being installed.
   b. *Twist out with pliers at the center of the twistout.*
   c. Close all unused open spaces in the cover using filler plates as listed on the cover directory label.
2. Attach the Spanish translation label, supplied with the load center, to rear of the cover.
3. Identify the branch circuits on the directory label.
4. If the load center is used as service equipment, apply the "Service Disconnect" label to the part of the cover nearest the main circuit breaker handle. If the load center *is not used as service equipment,* apply the "Main" label to the part of the cover nearest the main circuit breaker handle.
5. Install the cover using screws provided.



ENERGIZING THE LOAD CENTER

1. Before energizing the load center, turn OFF the main and all branch circuit breakers.
2. After power is turned ON to the load center, first turn ON the main circuit breaker and then turn ON the branch circuit breakers.

For questions about this equipment, call Application Engineering at Square D Company, Lexington, Kentucky, USA; 800-666-7557, 7:30 a.m.– 5:30 p.m. weekdays (Eastern Time).

Square D Company
1601 Mercer Road
Lexington, KY 40511 USA

40271-419-02 5/96 FP

SQUARE D

SIGNALINE®
DIV OF TIME MARK CORPORATION

Installation Instructions
36X Series Time Delay Relays

'7A212
,94

Time Mark Corporation
11440 East Pine • Tulsa, OK 74116

READ INSTRUCTIONS BEFORE INSTALLING, OPERATING OR SERVICING THIS DEVICE. KEEP THESE INSTRUCTIONS FOR FUTURE REFERENCE.

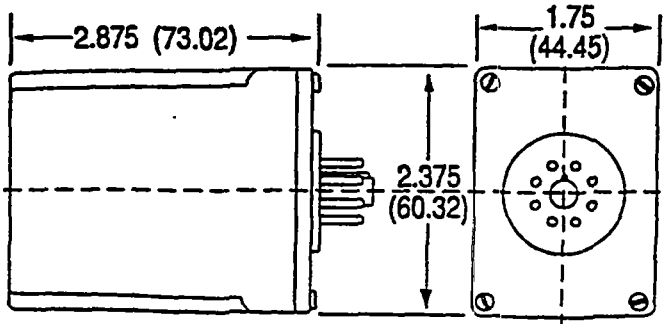
DESCRIPTION

The 36x series of Time Delay Relays consists of five timers: the 360 and 363 Operate Delay Timers, the 361 Release Delay Timer, the 362 Interval Timer, and the 368 Recycle Timer. Each is designed for a wide range of industrial applications, such as automatic and machine tool control circuits, HVAC circuits and warm-up delay circuits. Each model is a DPDT, high accuracy digital timer. All are available in a variety of voltage and timing ranges. Except for the 363, which is not agency certified, the 36x series of timers are UL Recognized at supply voltages of 120V or less, and CSA NRTL/C Certified in all voltage ranges.

SPECIFICATIONS

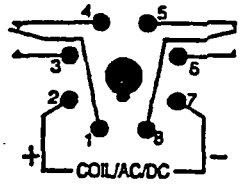
Supply voltage (except 363) . . . 12, 24, 120, 230V AC/DC
Supply voltage (363) . 12, 24, 120 VAC, 12, 24, 110 VDC
Timing range . . . 0.1-102.3 sec/1-1023 sec/1-1023 min
Contacts . . . . . DPDT
Contact rating . . . . . 10A @ 120VAC resistive

DIMENSIONS (All versions)

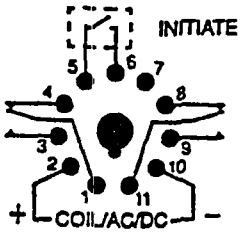


PIN CONFIGURATION

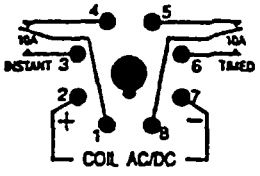
Models 360, 362, 368



Model 361



Model 363



GENERAL SAFETY

Potentially hazardous voltages are present at the base and socket area of the relay. All electrical power should be removed when connecting or disconnecting wiring. The unit should be installed and serviced by qualified personnel.

INSTALLATION

The procedure to determine the switch selections for the Models 360, 361, 362 and 368 requires some simple calculations which can be completed easily after the basic steps are explained.

1. Convert the time required to minutes, seconds, or tenths of seconds, depending upon the timing range of the unit. For example:

7 hrs, 32 mins = 420mins (7x60) + 32mins = 452 mins
15 mins, 2 secs = 900secs (15x60) + 2secs = 902 secs
90.7 secs is set as 907, omitting the decimal point.

2. To determine which switches to set "ON" for the desired time, you must perform a series of subtractions from the desired time (using binary numbers) until the remainder is equal to zero. The subtraction process must begin with the largest binary number that can be subtracted from the desired time. The remainder from each subtraction must be reduced by the next largest binary number that can be subtracted from the desired time. The remainder from each subtraction must be reduced by the next largest binary number that can be subtracted from the remainder, until it is zero. (See Figure 1).

Figure 1

Binary numbers	Time Delay 300 seconds	Time Delay 400 seconds
512	300	400
256	-256	-256
128	44	144
64	-32	-128
32	12	16
16	-8	-16
8	4	0
4	-4	(256+128+16=400)
2	0	
1	(256+32+8+4=300)	

SIGNALINE®
DIV OF TIME MARK CORPORATION

Installation Instructions
36X Series Time Delay Relays

Time Mark Corporation
11440 East Pine • Tulsa, OK 74116

ode: ☐ = switch OFF ◉ = switch ON

Figure 2

360-1 sec set at 600 second delay

1	
2	
4	
8	●
16	●
32	
64	●
128	
256	
512	●

Figure 3

361-.1 sec set at 90.7 sec delay

1	●
2	●
4	
8	●
16	
32	
64	
128	●
256	●
512	●

Figure 4

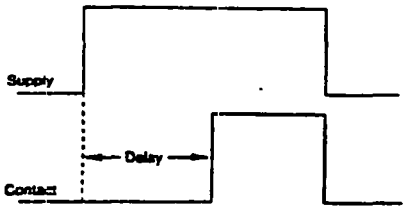
8-1 min set at 5 min OFF, 55 min ON

1	●	●	OFF
2		●	4+1=5
4	●	●	ON
8			32+16+4
16		●	2+1=55
32		●	
64			
128			
256			
512			

OPERATION

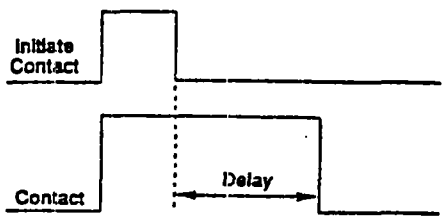
Model 360 Operate Delay Relay

The time delay begins when the supply voltage is applied. On completion of the delay period the internal relay will energize, and remain energized until the supply voltage is removed.



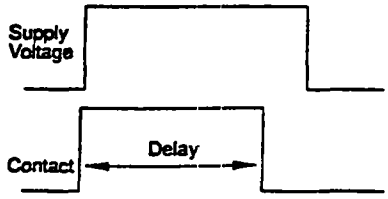
Model 361 Release Delay Relay

The supply voltage must be constantly applied. When the control switch is closed the internal relay will energize. Timing begins when the control switch is opened. The delay can be reset by again closing the control switch. On completion of the delay period the relay will de-energize.



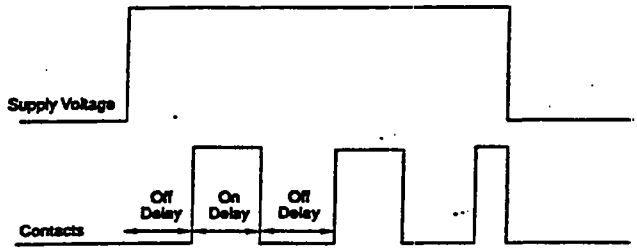
Model 362 Interval Timer

The internal relay energizes immediately on application of the supply voltage. Upon completion of the delay period, the relay de-energizes. The supply voltage must be removed to reset the timer.



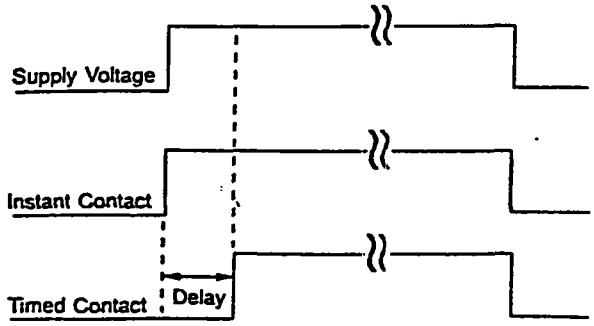
Model 368 Recycle Timer

When the supply voltage is applied, the OFF cycle begins timing. Upon completion of the delay, the internal relay energizes and the ON cycle begins timing. The timer will continue cycling until the supply voltage is removed. On and OFF cycles can be of equal or unequal duration.



Model 363 Operate Delay Relay

When supply voltage is applied, one contact immediately transfers, and the time delay begins. On completion of the delay period the second contact will transfer. The contacts remain in this state until the supply voltage is removed.



WARRANTY

The 36x series timers are designed for long life and trouble-free operation, and require no special care. There are no user-replacement parts within the unit. All are covered by Time Mark's 5-Year Unconditional Warranty. For complete warranty information, refer to the Terms and Conditions page in your Time Mark catalog. Signaline is a registered trademark of Time Mark Corporation.

– Instructions –

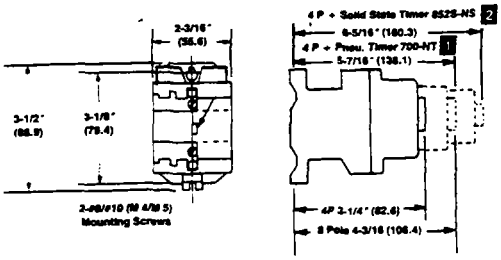
Bulletin 700 • Type N • AC Relays

NOTE: Save this sheet for future use.

CAUTION

1. Disconnect power before servicing.
2. Retighten screws securely to specified torque.
3. Check for proper reassembly. Red bar is flush with cover when de-energized. Red bar or metal push-to-test tab on time delay unit must move freely through 9/64" (3.6) stroke when manually operated.
4. Use suitable enclosure to protect the contacts and magnet pole faces from dust, dirt, lint, oil mists, water or other contaminants. Do not spray solvent type contact cleaners into installed cartridges.
5. Do not apply oil, grease, rust inhibitors, or any spray to the magnet pole faces. Resulting films or residues could cause magnet sticking.

Installation



NOTE: Dimensions shown in parenthesis are in millimeters.

Type N relays are designed for two-point mounting on a vertical panel with coil terminals upward.

Self-lifting Terminal Clamps accept the following:

- Two #12 AWG (4.0 mm²) solid or stranded copper wire max. to one #18 AWG (0.75 mm²) min. Use a Strip Length of 5/16" (7.9)
- Two ring terminals — 21/64" max. tongue width or smaller (8.3 max.). Hole for a #6 Screw.
- Three ring terminals — long tongue type (AMP #33173 or equivalent)

Mounting Strip

Accessory mounting strips accomodate 4, 8, 12 or 16 relays and can be sawed to intermediate lengths.

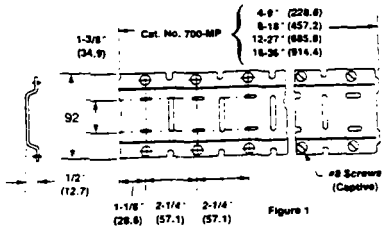


Figure 1

1.1 Mount strips horizontally with #8 screws, with at least one screw at each end and in an alternating upper and lower horizontal pattern with 2-1/4" (57.1) or 4-1/2" (114.2) spacing. If #10 screws are used, spacing may be increased to 6-3/4" (170.6).

1.2 Tighten #8 staked mounting strip screws securely 14-20 lb-in. (1.6-2.3 N·m).

1.3 Tighten unused screws in vacant positions to 7-14 lb-in. (.8-1.6 N·m) to resist loosening and falling out due to vibration.

1 NOTE: Relays field modified with any accessories described retains U.L. Listing and CSA Certification. See Tables 1 & 2.

NOTE: See Catalog for Range Designation & Options.

Contact Cartridges

Accessory contact cartridges are individually stamped on the side for identification. Factory-installed units, when not stamped, can be identified by the colors of component parts. See Table 1

Table 1

Accessory Contact Cartridges 1					
Type of Contact Cartridge	Catalog No. Rear Deck	Catalog No. Front Deck	Color of Housing	Color of Spanner Guide	Plating on Terminal
Standard	700-C1	700-C2	Lt. Gray	White	Silver
Gold Plated	700-C1X	700-C2X	Lt. Gray	White	Gold
Bifurcated	700-C1B	700-C2B	Dk. Gray	White	Silver
Overlap	700-C11Z	700-C22Z	Lt. Gray	Black	Silver
Logic Reed	700-C1R	–	White	White	Gold
Pneu. Timer	X-457011		Tan	White	Silver

- Gold plated contact cartridges. Tab and contact symbol one end only. Resist tarnish films. In absence of environmental dirt they provide higher reliability than standard cartridge below 24 volts.
- Bifurcated contact cartridge. Lightweight movable contact provides better shock and vibration resistance
- Overlap contact cartridges. Sold in pairs. Tab and contact symbol one end only. Convertible to Early Make N.O. or Late Break N.C. Use together for overlap. DC rating is 125 volts maximum.
- Logic reed contact cartridge. Hermetically sealed contact for greater reliability in low energy switching. Rear deck only. Resistive rating.

AC 150V Max., 150 mA Max., 8 VA Max.
DC 30V Max., 60 mA Max.

Converting Contacts

To convert contacts (N.O. ⟷ N.C.):

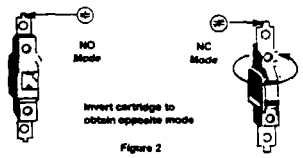


Figure 2

2.1 Remove cover (or front mounted accessory) with its two captive screws.

2.2 Remove terminal screws of cartridge.

2.3 Remove, invert and reinstall cartridge and terminal screws. Figure 2.

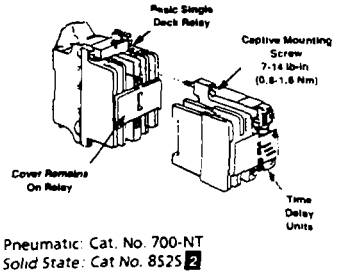
2.4 Replace cover (or accessory) and tighten screws securely

IMPORTANT

- Front cartridges, Rear cartridges, and Pneu. Timer cartridges are not interchangeable
- Vacant positions in rear deck must contain a white dummy plunger (Renewal part F27185) to maintain design pick-up voltage.

Adding A Time-Delay Unit

Time delay units include separate instructions.



1 Pneumatic: Cat. No. 700-NT
Solid State: Cat No. 8525 2

Table 2

Other Accessory Kits 1	Cat. No.
Jumper for Middle Pole to Outer Pole	700-N3
Jumper for Middle Poles	700-N4
Surge Suppressor (Terminal Mounted)	700-N24
Surge Suppressor (Mounted under relay)	700-N5
Check-Out Tool	700-N21

Adding A Front Deck

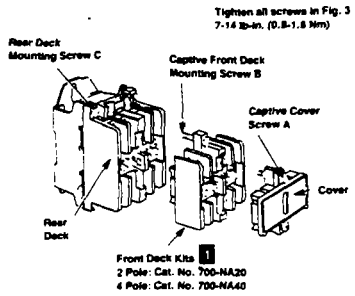


Figure 3

3.1 Remove cover and two captive screws A.

3.2 Convert any **Rear** deck cartridges to N.C.

3.3 Position front deck on relay. Note that a keying provides orientation. Tighten the captive mounting screws B securely.

3.4 Convert any **Front** deck cartridges to N.C.

3.5 Reinstall cover (note keying) and tighten the two captive cover screw A securely.

Coil Or Yoke And Armature Replacement

4.1 Pry coil outward with screwdriver in slot between coil terminals Fig. 4.

4.2 Grasp magnet assembly as coil is removed so that loose parts do not separate and fall.

4.3 Select replacement coil and/or yoke and armature assembly. See Renewal Parts Publication 700-6.11.

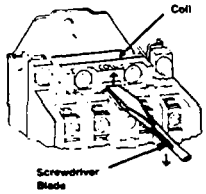


Figure 4

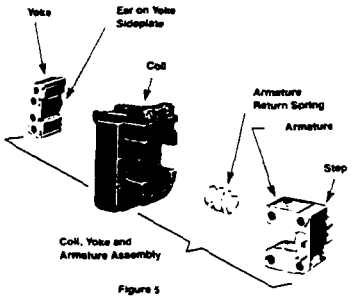


Figure 5

4.4 Reassemble replacement parts. Figure 5
- Be sure spring is seated between armature and coil
- Orient yoke so that ear on sideplate nests in recess in bottom of coil.
- Orient armature with step adjacent to coil terminals.

4.5 While holding parts together, slide the assembly into the mounting base until the unit locks into place.

4.6 Manually check for proper operation by depressing red center bar with screwdriver through 9/64" (3.6) stroke

IMPORTANT

If the coil is inserted in the base without the armature and yoke in place, it cannot be withdrawn without damaging the cartridge tips. Remove rear deck with its four captive screws C, Figure 3, to free the coil. Upon reassembly, tighten screws securely.

40061-022-01 (B)
Printed in U.S.A.

TYPE 1XXXX LIQUID LEVEL CONTROLS
INSTALLATION INSTRUCTIONS AND OPERATION

Form 70
Supersedes Forms
49,50,52,53,54

COMPONENT NUMBER: 1 X X X X

Contact Configuration	N.O.	N.C.
C	2	0
D	1	1
E	0	2
F	3	0
G	2	1
H	1	2
J	0	3

A.C. Line Volts	
1	115
2	230
4	460
5	575
6	115/
	230
7	24
9	380

Secondary Voltage/ Sensitivity/Distance	Volt	Sens	Dist/Ft
A	25	50	75000
B	75	450	7500
C	150	1.5K	1750
D	300	7K	500
E	500	20K	150

Nema Enclosure	
0	open
1	1
4	3,4,5
7	7,9
12	12

For on-board reset switches, add suffix letter "A" for normally open switch and letter "C" for normally closed switch.

These instructions should be used by experienced personnel as a guide to the installion of the Series 1 control.

The Series 1 may be wired in various manners. Select the wiring diagram that matches the contact configuration of your model number and the application you wish to perform. Mount the control on a vertical surface with the transformer on the left hand side. The control should be mounted in an enclosure of proper nema integrity and wired following national/local electrical codes. Terminals on the control are numbered and are in the same relative position as the terminals shown in the wiring diagrams.

Each control has a data label on the right hand side of the terminal block. Terminal pair 1-2 must be continuously energized from an A.C. supply line of the same electrical characteristics as shown on the data label.

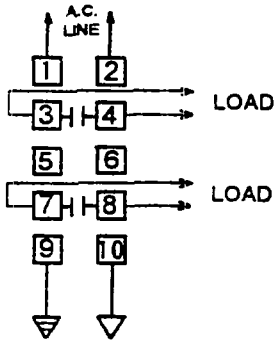
Each dry contact used for load duty must be wired in series with the load, and that series branch circuit connected across a power source compatible with the load.

Wiring must be provided to the electrode(s) as shown. Terminal 9 must be grounded to the vessel, if metallic. If the electrode fitting has a metallic body, and is supported directly upon a metallic vessel, the ground reference connection is facilitated by securing that end of the reference conductor beneath the head of one of the four screws which fasten the terminal housing to the body of the fitting. When the vessel is non-metallic, terminal 9 must be connected to an additional electrode of a length equal to, or longer than, the longest electrode used in the vessel.

The jumper between terminal pair 8-10 on diagrams X2, X3 and X4, and the wire pair between the control and pushbutton switch on diagrams X3 and X4, are required field wiring.

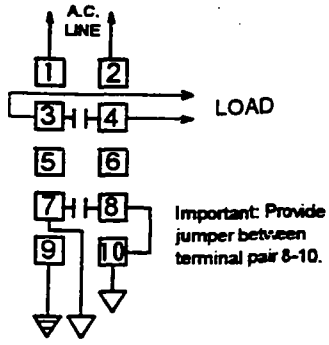
The control to fitting wire distance should not exceed that listed for the secondary voltage of your control.

DIAGRAM C1
SINGLE LEVEL SERVICE
HIGH LEVEL ALARM OR LOW LEVEL CUTOFF



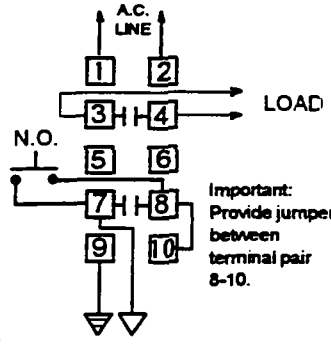
Contact Operation: Load contacts 3-4 and 7-8 close when the level rises to the electrode. They open when the level recedes below the electrode.

DIAGRAM C2
DIFFERENTIAL LEVEL SERVICE
PUMP DOWN



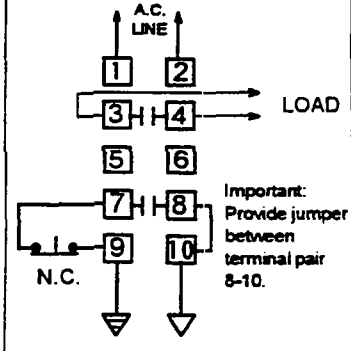
Contact Operation: Load contact 3-4 closes when the level rises to the short electrode connected to terminal 10. It opens when the level recedes below the long electrode connected to terminal 7.

DIAGRAM C3
LOW LEVEL LOCKOUT SERVICE
LOW LEVEL CUTOFF WITH MANUAL RESET



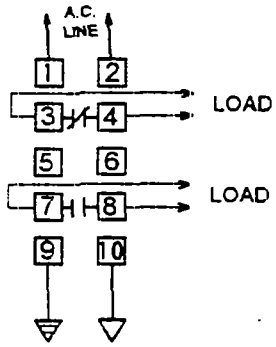
Contact Operation: Load contact 3-4 opens when the level recedes below the electrode. It closes when the level rises to the electrode and the normally open pushbutton switch is momentarily actuated.

DIAGRAM C4
HIGH LEVEL LOCKIN SERVICE
HIGH LEVEL ALARM WITH MANUAL RESET



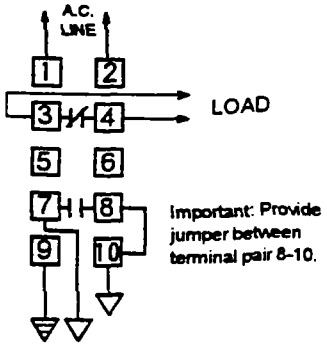
Contact Operation: Load contact 3-4 closes when the level rises to the electrode. It opens when the level recedes below the electrode and the normally closed pushbutton switch is momentarily actuated.

DIAGRAM D1
SINGLE LEVEL SERVICE
HIGH OR LOW LEVEL CUTOFF AND ALARM



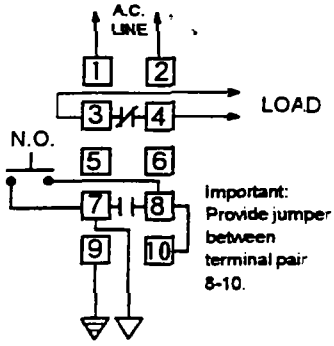
Contact Operation: Load contact 3-4 opens and load contact 7-8 closes when the level rises to the electrode. Contact 3-4 closes and contact 7-8 opens when the level recedes below the electrode.

DIAGRAM D2
DIFFERENTIAL LEVEL SERVICE
PUMP UP



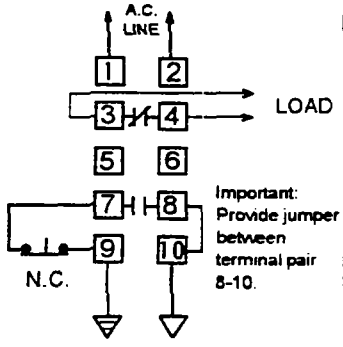
Contact Operation: Load contact 3-4 opens when the level rises to the short electrode connected to terminal 10. It closes when the level recedes below the long electrode connected to terminal 7.

DIAGRAM D3
LOW LEVEL LOCKOUT SERVICE
LOW LEVEL ALARM WITH MANUAL RESET



Contact Operation: Load contact 3-4 closes when the level recedes below the electrode. It opens when the level rises to the electrode and the normally open pushbutton switch is momentarily actuated.

DIAGRAM D4
HIGH LEVEL LOCKIN SERVICE
HIGH LEVEL CUTOFF WITH MANUAL RESET



Contact Operation: Load contact 3-4 opens when the level rises to the electrode. It closes when the level recedes below the electrode and the normally closed pushbutton switch is momentarily actuated.

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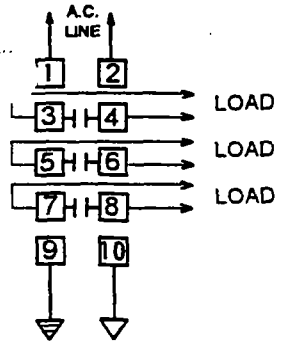
DIAGRAM F1

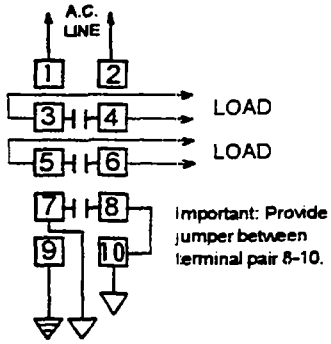
SINGLE LEVEL SERVICE
HIGH LEVEL ALARM OR LOW LEVEL CUTOFF



Contact Operation: Load contacts 3-4, 5-6 and 7-8 close when the level rises to the electrode. They open when the level recedes below the electrode.

DIAGRAM F2

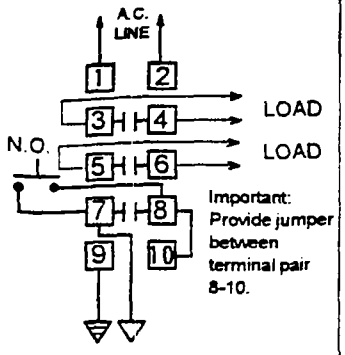
DIFFERENTIAL LEVEL SERVICE
PUMP DOWN



Contact Operation: Load contact 3-4 and 5-6 close when the level rises to the short electrode connected to terminal 10. They open when the level recedes below the long electrode connected to terminal 7.

DIAGRAM F3

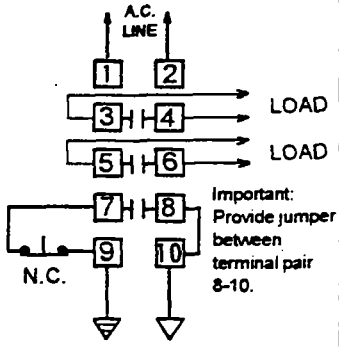
LOW LEVEL LOCKOUT SERVICE
LOW LEVEL CUTOFF WITH MANUAL RESET



Contact Operation: Load contacts 3-4 and 5-6 open when the level recedes below the electrode. They close when the level rises to the electrode and the normally open pushbutton switch is actuated.

DIAGRAM F4

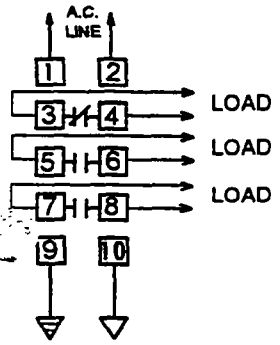
HIGH LEVEL LOCKIN SERVICE
HIGH LEVEL ALARM WITH MANUAL RESET



Contact Operation: Load contacts 3-4 and 5-6 close when the level rises to the electrode. They open when the level recedes below the electrode and the normally closed pushbutton switch is actuated.

DIAGRAM G1

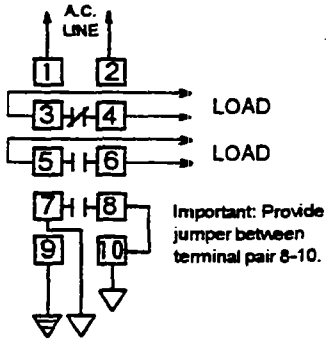
SINGLE LEVEL SERVICE
HIGH OR LOW LEVEL CUTOFF AND ALARM



Contact Operation: Load contact 3-4 opens and load contacts 5-6 and 7-8 close when the level rises to the electrode. Contact 3-4 closes and contacts 5-6 and 7-8 open when the level recedes below the electrode.

DIAGRAM G2

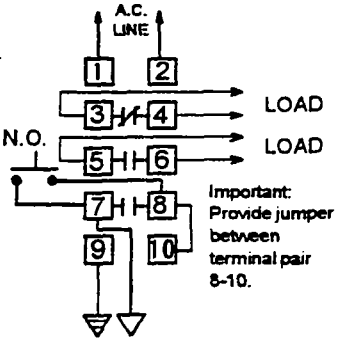
DIFFERENTIAL LEVEL SERVICE
PUMP DOWN OR PUMP UP



Contact Operation: Load contact 3-4 opens and load contact 5-6 closes when the level rises to the short electrode connected to terminal 10. Contact 3-4 closes and contact 5-6 opens when the level recedes below the long electrode connected to terminal 7.

DIAGRAM G3

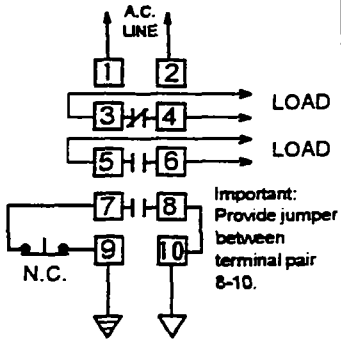
LOW LEVEL LOCKOUT SERVICE
LOW LEVEL CUTOFF & ALARM WITH MANUAL RESET



Contact Operation: Load contact 3-4 closes and load contact 5-6 opens when the level recedes below the electrode. Contact 3-4 opens and contact 5-6 closes when the level rises to the electrode and the normally open pushbutton switch is momentarily actuated.

DIAGRAM G4

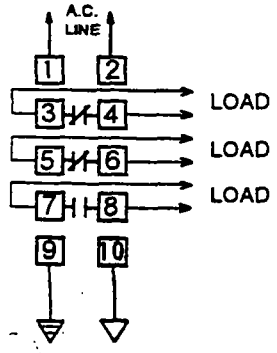
HIGH LEVEL LOCKIN SERVICE
HIGH LEVEL CUTOFF & ALARM WITH MANUAL RESET



Contact Operation: Load contact 3-4 opens and load contact 5-6 closes when the level rises to the electrode. Contact 3-4 closes and contact 5-6 opens when the level recedes below the electrode and the normally closed pushbutton switch is momentarily actuated.

DIAGRAM H1

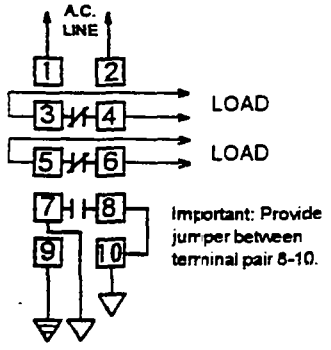
SINGLE LEVEL SERVICE
HIGH OR LOW LEVEL CUTOFF AND ALARM



...tact Operation: Load contact 3-4 and 5-6 open and contact 7-8 closes when the level rises to the electrode. Contacts 3-4 and 5-6 close and 7-8 opens when the level recedes below the electrode.

DIAGRAM H2

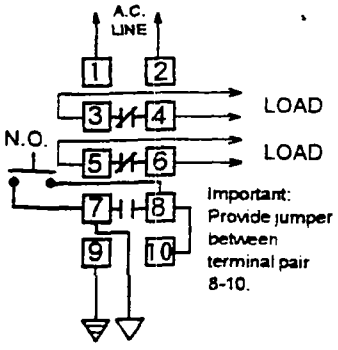
DIFFERENTIAL LEVEL SERVICE
PUMP UP



Contact Operation: Load contact 3-4 and 5-6 open when the level rises to the short electrode connected to terminal 10. They close when the level recedes below the long electrode connected to terminal 7.

DIAGRAM H3

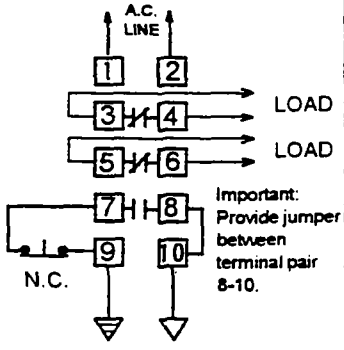
LOW LEVEL LOCKOUT SERVICE
LOW LEVEL ALARM WITH MANUAL RESET



Contact Operation: Load contact 3-4 and 5-6 close when the level recedes below the electrode. They open when the level rises to the electrode and the normally open pushbutton switch is actuated.

DIAGRAM H4

HIGH LEVEL LOCKIN SERVICE
HIGH LEVEL CUTOFF WITH MANUAL RESET



Contact Operation: Load contact 3-4 and 5-6 open when the level rises to the electrode. They close when the level recedes below the electrode and the normally closed pushbutton switch is actuated.

TYPE PK MASTER CONTROL RELAYS, AND TIME-DELAY AND LATCH UNITS

NOTE: See Bulletin 700 Type P AC Relay instructions and DC Relay instructions for additional information

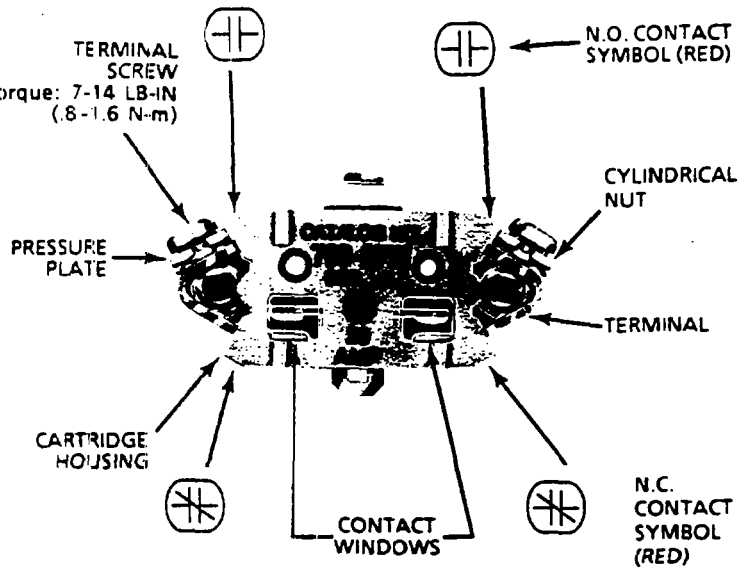
WARNING: Disconnect power before servicing

GENERAL

The Bulletin 700, Type PK, 600 Volt Master Control Relay line is similar to the Type P Relay line in all respects except that it provides higher current switching capabilities. The Type PK is provided with a red cover label for easy identification. All information in the Bulletin 700 Type P instructions applies to the Type PK with the following additions.

CONTACT CARTRIDGES

The Type PK Relay is equipped with master cartridges. These cartridges are marked with the conventional symbols ⊣⊢ for normally open and ⊣/⊢ for normally closed operation. The master contact cartridge housing is gray in color with red operating mode symbol markings. This makes the master cartridge easily distinguishable from other types of cartridges even when installed in the relay. The master cartridge has "windows" in the housing to permit inspection of the contacts. It also has "SWINGAROUND" terminals for ease in converting contacts.



CAUTION

1. Use Cu wire rated at 75 deg C or higher.
2. For normal low current or control relay switching applications, do not use master cartridges. The standard cartridge with bifurcated contacts provides a higher reliability in these applications.

ADDING CARTRIDGES

Table 1 below lists the contact cartridges available for use in the Type PK relay. [1] Follow instructions for adding cartridges in the Type P instruction sheet.

TABLE 1

Cartridge Type	Cat. No.
Standard Cartridge	700 - CP1
Overlap Cartridge	700 - CP11Z
Logic Reed Cartridge	700 - CPR
Master Cartridge	700 - CPM
35 AMP Jumper Kit (Use 2 Master Cartridges)	700 - CPH

[1] Addition will not void U.L. Listing.

Master or other cartridges may be added to existing decks, or additional decks may be added. Time delay units and mechanical latch units may be added to Type PK Relays as described in Type P instruction sheets.

MASTER CARTRIDGE CONTACT RATINGS

AC Application

The master cartridge is suitable for switching the total load of a process or machine in many instances. It is designed to carry continous loads if up to twice the 10 amp rating of the standard cartridge (700-CP1).

700-CPM RATINGS:

Master pilot duty - See Table 2

- 20 amp general use .75 PF to 600V
- 20 amp resistive heating to 600V
- 20 amp tungsten lamp load to 480V

AC-single phase	N.O./N.C.
3HP @ 240V	N.O./–
2HP @ 240V	N.O./N.C.
1HP @ 120V	N.O./N.C.

TABLE 2

Master Pilot Duty

Volts AC Ue ~	Make ⊣⊢	Break ⊣/⊢
120-600	14.4KVA	1.44KVA
72-120	120A	1.44KVA
12-72	120A	20A

Continuous Carrying Current: 20 Amps

Use CU Wire, 75°C or Higher.

NOTE: In compliance with AC-11 requirements of IEC Std 337, the master cartridge will switch the rated make load 50 times.

DC APPLICATION

Because of the heavier construction of the master cartridge, it is suitable for switching heavy duty DC loads (see rating table below). The master cartridge will last about 2 to 3 times longer than the standard cartridge (700-CP1) for the same DC inductive load according to laboratory tests.

TABLE 3

DC - Current Ratings - Single Cartridge

NEMA Rating	Volts DC ⎓	Make / Break ⊣⊢ ⊣/⊢
P600	301-600	120 VA
P600	151-300	138 VA
N150	65-150	275 VA
N150	33-64	320 VA
N150	6-32	10 AMP

Continuous Carrying Current: 10 Amps

For higher current ratings, two or more cartridges may be connected in series. See Table 4.

TABLE 4

DC - Current Ratings

Contacts In Series	24 Volts	64 Volts	125 Volts	250 Volts	500 Volts	600 Volts
1	10A	5A	2.2A	0.55A	0.24A	0.2A
2	20A	10A	5A	2A	0.7A	0.5A
3	—	15A	7A	3A	1.5A	1.0A
4	—	20A	10A	5A	2.5A	1.5A

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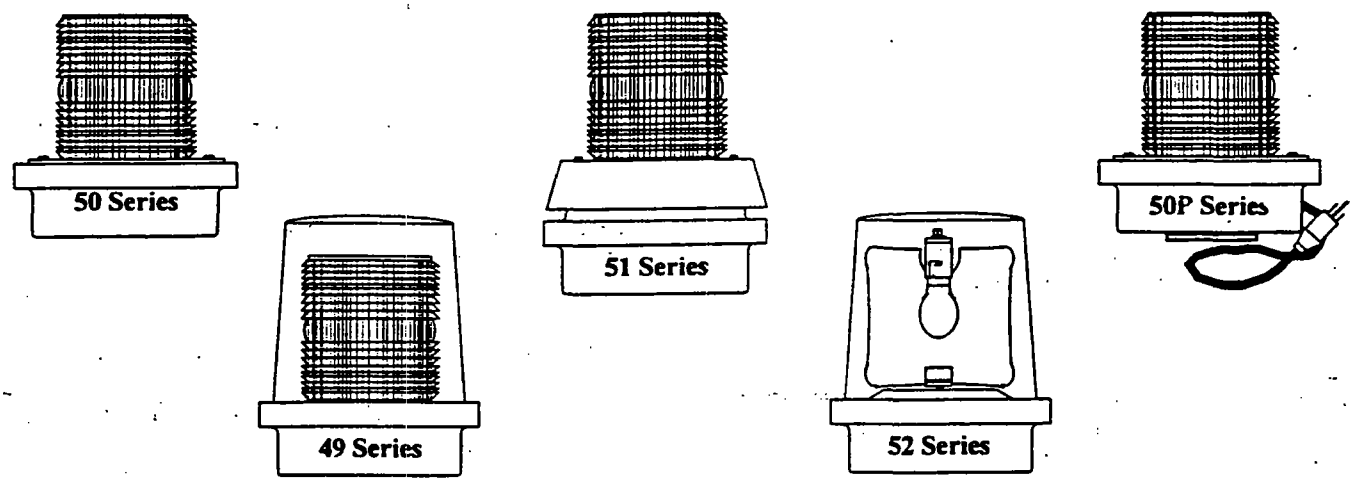
A UNIT OF GENERAL SIGNAL GS

EDWARDS

Installation and Maintenance Instructions

for Catalog Series 49, 50, 50SIN, 50P, 51 and 52 ADAPTABEACON® SIGNALS



GENERAL INFORMATION

Catalog Series 49, 50, 50SIN, 50P, 51 and 52 Adaptabeacon signals are UL Listed, general purpose visual and visual/audible signaling appliances. The 49, 50 and 50P series are flashing lights. The 50SIN is a steady-on light. The 50P series comes with a magnetic mounting disk on the base and a 66" grounded cord and plug. It can be attached to any steel surface and is ideal for temporary mounting. The 51 series are combination flashing lights with horn. The 51 series come in single and double horn versions; the double horn version is denoted by a 2H in its catalog number. The 52 series are rotating lights.

The 49, 50, 50SIN, 51 and 52 series signals are suitable for indoor or outdoor (weatherproof) installation and utilize a standard base that allows direct surface mounting, mounting on a 4" octagon box, or mounting on 1/2" NPT conduit. For outdoor installation, the signals must be mounted on conduit. The 50P series are suitable for indoor use only.

For product specifications refer to the "Specifications" section of these instructions for details. Replacement lamps, flashers, domes, and lenses for the signals are available. Refer to the "Replacement Parts" section of these instructions for details.

CAUTIONS

1. Ensure that power is disconnected before installing the signal.
2. Permanently affixed gaskets are provided where required in the signals for weatherproofing. Use care when disassembling the signal to prevent tearing of these gaskets.

INSTALLATION

Install in accordance with the latest edition of the National Electrical Code and local regulations.

50P Series: For the 50P series signals, simply select a suitable indoor steel surface and plug the signal's power cord into a 120Vac, 60Hz outlet and verify that the signal operates properly.

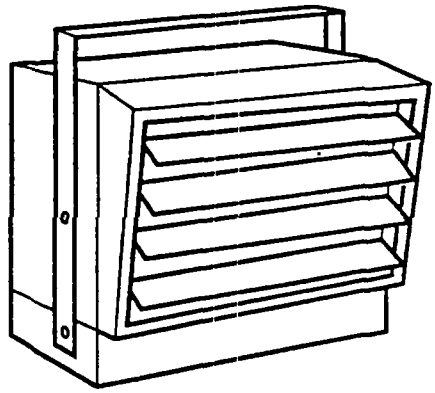
STEP 1 - For the 49, 50, 50SIN, 51 and 52 series signals, remove the base from the signal using one of the following applicable procedures:

49 Series: See Figure 1. Remove the screw in the clamp ring, remove the ring, and lift off the dome. Loosen the three screws in the base of the lens and turn the lens clockwise to remove. Then remove the two screws that are partially set into the raised area of the lamp assembly mounting plate, lift the assembly off of the base, and pull the wire leads out of the conduit entrance hole in the base. Now proceed to Step 2 for installation of the base.

50 and 50SIN: See Figure 2. Remove the screw in the clamp ring, remove the ring, lift the lens/lamp assembly off of the base, and pull the wire leads out of the conduit entrance hole in the base. Now proceed to Step 2 for installation of the base.

Marley Electric Heating

A United Dominion Company



UL LISTED c UL

FILE #E21609

Model No. UH-524TA

Horizontal / Vertical Unit Heater

(Field Adjustable from 1.9KW @ 208V to 5KW@ 240V

Installation & Maintenance Instructions

Dear Owner,

Congratulations! Thank you for purchasing this new heater manufactured by a division of Marley Electric Heating. You have made a wise investment selecting the highest quality product in the heating industry. Please carefully read the installation and maintenance directions shown in this manual. You should enjoy years of efficient heating comfort with this product from Marley Electric Heating... the industry's leader in design, manufacturing, quality and service.

... The Employees of
Marley Electric Heating

⚠ WARNING ⚠

Read Carefully - These instructions are written to help you prevent difficulties that might arise during installation of heaters. Studying the instructions first may save you considerable time and money later. Observe the following procedures, and cut your installation time to a minimum.

1. Use minimum 60° copper wire only.
2. Heater air flow must be directed parallel to, or away from, adjacent walls.
3. Observe wall, floor, and ceiling clearance requirements.
4. All wiring must conform to national and local electrical codes and the heater must be grounded as a precaution against possible electrical shock. Heater circuit must be protected with proper fuses. See Table 1 on page 4.
5. The mounting structure and the anchoring hardware must be capable of reliably supporting the weight of the heater and, if used, the mounting bracket.
6. All electrical power must be disconnected at the main service box before installing, inspecting, cleaning or servicing the heater. This is a precaution to prevent serious electrical shock.
7. This heater is not suitable for use in hazardous locations as defined by the National Fire Protection Association (NFPA). This heater has hot and arcing (sparking) parts inside. Do not use in areas where gasoline, paint, or flammable liquids are used or stored.
8. *This heater is not suitable for use in corrosive atmospheres* such as marine green houses or chemical storage areas.
9. This heater must be mounted at least 6 feet (1829 mm) off the floor.
10. This unit only operates on 240 or 208 volts AC. Improper installation or failure to follow the procedures outlined in this instruction manual can result in serious electrical shock.

SAVE THESE INSTRUCTIONS

INTRODUCTION

Your new heater has unmatched operating flexibility, designed to meet a variety of heating requirements by simply switching a few easily accessible wires located in the base of the unit. With heat output ranging from 6,396 to 17,065 BTU per hour, this unique feature lets you use a single unit to meet a wide range of heating applications.

This manual shows you how to install, operate, and maintain your UH-524TA electric heater.

Unpacking Your New Heater

Remove the heater from the box and inspect it for any damage. If it appears to be damaged, immediately return it to the store from which you purchased it.

Check the contents of the box to make sure it contains one heating unit and one mounting bracket.

Tools Needed

You will need the following tools to install your UH-524TA electric heater:

- Screwdriver
- Needle nose pliers
- Pliers
- Electric Drill and 1/4" (6.35) bit
- Adjustable wrench

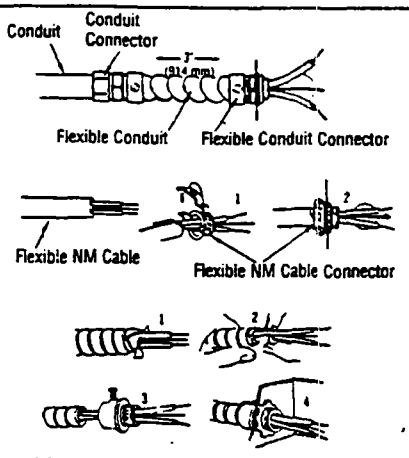
Hardware Needed

You will also need the following hardware for installation:

- Enough 10 ga. min. insulated copper conductor (with ground) wire to run power from the breaker/ fuse to the heater. Only use copper wire rated at least 60° C. Do *not* use aluminum wire with this unit.
- Proper size fuses and circuit breakers in accor-dance with the National Electrical Code. Also see Table 1, page 5.
- Screw wood, 3/8" x 2" (9.5 mm x 50 mm) Lag bolts (Qty. 1 or 2).
- Washer, 3/8" (9.7 mm) (Qty. 2)
- Wire connectors sized to your application.

NOTE: For certain applications, conduit may be required (see Fig. 1). Check local electrical codes. Also, if you run the wiring in conduit and wish to be able to turn the heater, be sure to purchase enough flexible conduit to allow the heater to be turned.

Figure 1

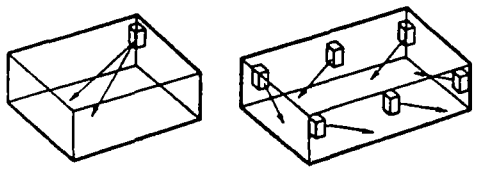


Connectors, cable, and hardware used to wire the UH-524TA

FINDING THE BEST LOCATION FOR YOUR HEATER

The heater should be installed out of traffic areas and at least 6' off the floor. The direction of air flow should not be restricted (ie: by columns or machinery) and the air flow should wipe exposed walls, rather than blowing directly at them. When more than one heater is used in an area, the heaters should be arranged so that the air discharge of each heater supports the air flow of the others to provide best circulation of warm air, as indicated in figure 2, below.

Figure 2



Mounting Height

When the air flow of the heater is directed vertically, the minimum mounting height is 6 feet (1829 mm), the maximum mounting height is 11 feet (3353 mm). When the air flow of the heater is directed horizontally the minimum mounting height is 6 feet (1829 mm) and the maximum recommended height is 8 feet (2438 mm).

Distance from Walls

When the heater is mounted so that the air flow direction is at an angle from horizontal to 45° downward, the distance from the mounting bracket to any wall should be at least 13 inches (330.2 mm). When the heater is mounted so that the direction of air flow is at an angle between 45° downward and vertical, the distance from the mounting bracket to any wall should be at least 48 inches (1219 mm).

1. Mounting the Bracket

Locate a stud in the ceiling and attach the mounting bracket to the ceiling joist as shown in figures 3-A or 3-B. You will need to remove the mounting bracket from the heating unit by loosening the bracket screws with a wrench and slipping the handle off over the screw heads. Remember to place a washer on the screws before you insert them through the holes in the mounting bracket and screw them into the stud. Tighten the screws enough to securely hold the heating unit with the air flow pointed in the proper direction.

Figure 3-A

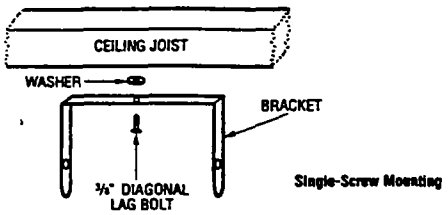
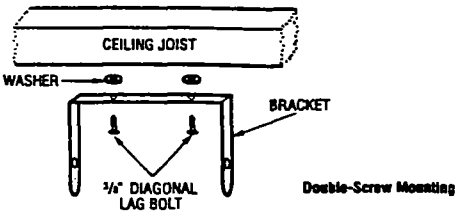


Figure 3-B



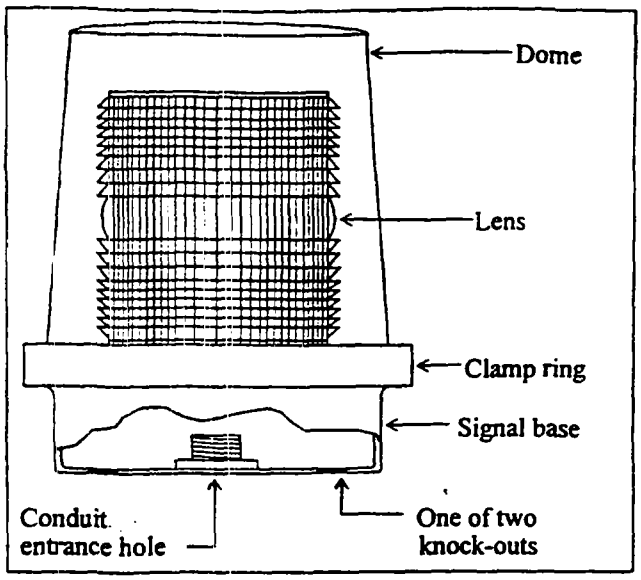


Figure1. Catalog Series 49 Flashing Lights.

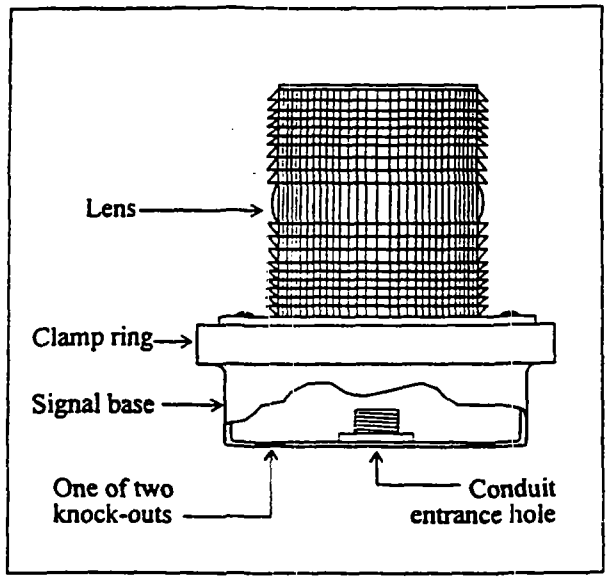


Figure 2. Catalog Series 50, 50SIN, and 50P Flashing Lights. *(Series 50 shown)*

51 Series: See Figure 3. Remove the screw in the clamp ring, remove the ring, lift the lens/lamp assembly off of the base, and pull the wire leads out of the conduit entrance hole in the base. Now proceed to Step 2 for installation of the base.

52 Series: See Figure 4. Remove the screw in the clamp ring, remove the ring, and lift off the dome. Then remove the two screws in the rotating lamp assembly mounting plate, lift the assembly off of the base, and pull the wire leads out of the conduit entrance hole in the base. Now proceed to Step 2 for installation of the base.

STEP 2 - For indoor installation, the signal may be direct surface mounted, mounted on a 4" octagon box, or mounted on 1/2" NPT conduit. For outdoor (weatherproof) installation, the signal must be conduit mounted. Install the signal base using one of the following applicable mounting procedures.

Direct Surface Mounting
(indoor installation only)

CAUTION

For direct surface mounting, the 49, 50, 50SIN, and 51 series signals may be installed in any position but the 52 series rotating lights must be installed with their dome facing either directly up or down.

- Remove the two knock-outs for mounting screws from the bottom of the signal base.
- Route the field wiring from the required power source through the conduit entrance hole in the base. Power source requirements are in the Replacement Parts and Specifications Chart.
- Fasten the base to the surface by installing two #10 wood screws (not supplied) or other suitable hardware through the knock-out holes in the base. Now proceed to step 3 for wiring connections.

Mounting on a 4" Octagon Box
(indoor installation only)

CAUTION

For octagon box mounting, the 49, 50, 50SIN, and 51 series signals may be installed in any position but the 52 series rotating lights must be installed with their dome facing either directly up or down.

- Remove the two knock-outs for mounting screws from the bottom of the signal base.
- Route the field wiring from the required power source through the conduit entrance hole in the base. Power source requirements are in the Replacement Parts and Specifications Chart.
- Fasten the base to the octagon box (not supplied) by installing the screws supplied with the box through the knock-out holes in the base. Now proceed to Step 3 for wiring connections.

Mounting on 1/2" NPT Conduit
(indoor or outdoor installation)

CAUTION

For conduit mounting indoors, the 49, 50, 50SIN, and 51 series signals may be installed in any position but the 52 series rotating lights must be installed with their dome facing either directly up or down. For conduit mounting outdoors, the 49, 50, 50SIN, 51 and 52 series signals must be installed with their dome facing directly up.

- Route the field wiring from the required power source through the conduit entrance hole in the base. Power source requirements are in the "Specifications" section on the last page of these instructions.
- Install the base on the conduit (not supplied). Now proceed to Step 3 for wiring connections.

SPECIFICATIONS

CATALOG NUMBER	RATED VOLTAGE	CURRENT
49(*)-R5	240 Vac 60 Hz	.10 amp
50(*)-R5	240 Vac 60 Hz	.10 amp
52(*)-R5	240 Vac 60 Hz	.10 amp
49(*)-N5-40W	120 Vac 60 Hz	.26 amp
50(*)-N5-40W	120 Vac 60 Hz	.26 amp
50P(*)-N5-40W	120 Vac 60 Hz	.26 amp
50SIN(*)-N5-40W	120 Vac 60 Hz	.28 amp
51(*)-N5-40W	120 Vac 60 Hz	.29 amp
512H(*)-N5-40W	120V ac 60 Hz	.29 amp
52(*)-N5-40W	120 Vac 60 Hz	.30 amp
50(*)-G5	24 Vac 60 Hz	.9 amp
51(*)-G5, 52(*)-G5	24 Vac 60 Hz	1.1 amp

REPLACEMENT PARTS

Replacement lamps, flashers, lenses, and domes for the 49, 50, 50 SIN, 50P, 50 SINP, 51 and 52 series signals may be obtained from your Edwards distributor. The catalog numbers or part numbers for these components are as follows.

REPLACEMENT COMPONENT	SIGNAL CAT. NO.	REPLACEMENT COMPONENT CATALOG PART NUMBER
Lamp - 40 Watt double contact, bayonet base	49(*)-N5-40W, 50(*)-N5-40W, 50P(*)-N5-40W, 50 SIN(*)-N5, 51(*)-N5-40W, 512H(*)-N5-40W, 52(*)-N5-40W	50 LMP-40W (CTN of 6) P-041695-0108 (single lamp)
Lamp - 25 Watt (optional replacement)		P-S47949-0191 or industry trade no. 25T8DC
Lamp - 32 Watt double contact, bayonet base	50(*)-G5, 51(*)-G5, 52(*)-G5	P-041695-0099 or industry trade no. 1638
Solid state flasher module	49(*)-N5-40W, 50(*)-N5-40W, 50P(*)-N5-40W, 51(*)-N5-40W, 512H(*)-N5-40W	P-041917-0026
Solid state flasher module	50(*)-G5, 51(*)-G5	P-041917-0029
Horn	51(*)-N5-40W, 512H(*)-N5-40W	123A-N5
Horn	51(*)-G5	123A-G5
Dome (Clear)	49(*)-R5, 49(*)-N5-40W	52-LC
Dome (Amber, Blue, Clear, Green, Magenta, or Red)	52(*)-N5-40W, 52(*)-R5, 52(*)-G5	52-L(*) - See below
Lens (Amber, Blue, Clear, Green, Magenta, or Red)	49(*)-R5, 49(*)-N5-40W, 50(*)-R5, 50(*)-N5-40W, 50(*)-G5, 50P(*)-N5-40W, 50SIN(*)-N5-40W, 51(*)-N5-40W, 512H(*)-N5-40W, 51(*)-R5, 51(*)-G5	92-L(*) - See below

* Specify color of item by adding one of the following letters to the catalog number: A-amber, B-blue, C-clear, G-green, M-magenta, or R-red. Examples: A red dome for the 52 series signal is 52-LR; a blue lens for the 50 series signal is 92-LB.

2. Hanging the Heater

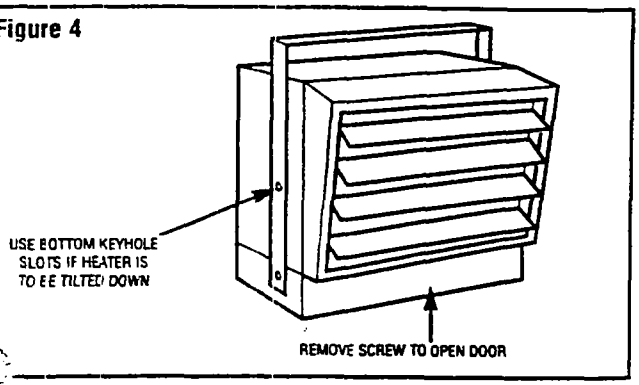
Attach the heating unit to the mounting bracket. Lift the heater up and into the mounting bracket. The bracket screws, located on each side of the heating unit, allow the heater to be attached easily to the mounting bracket by aligning the screws with the keyhole slots in the mounting brackets. If the heater is to be tilted, it must be positioned in the lower keyhole slots (see Fig. 4). Tighten the bracket screws with a wrench so the unit is securely suspended at the desired horizontal or vertical level.

3. Connecting the Power

To connect the power to the heater, simply remove the screw from the front of the unit. This allows the hinged bottom to open, providing access to the electrical wiring and connectors. (See Fig. 4)

Attach the cable connectors to the unit (See Fig. 1) and slide the 10 gauge wire through the cable connector. Pull enough of the wire through the connector so you will have enough wire to work with when you make the the connections.

Figure 4



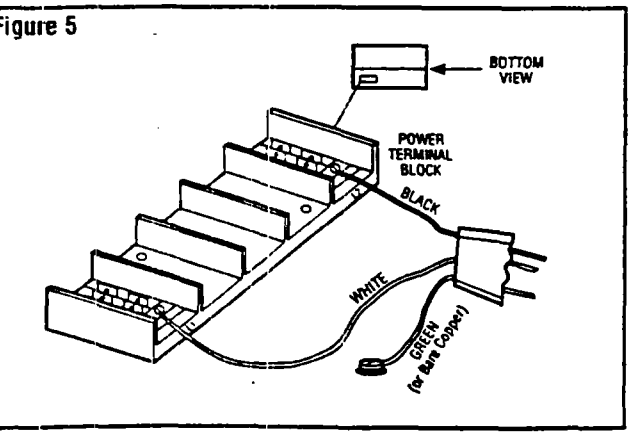
NOTE: Wiring compartment volume = 370 in³ (6063 cm³)

Connect the wire to the power terminal block located in the base of the heater (See Fig. 5).

NOTE: To decrease the heat output of the heating unit, see Table 1 and schematic diagram on page 4.

Turn on the power at the main service.

Figure 5



OPERATION

Setting the Thermostat

Rotate thermostat knob clockwise to high position. After room reaches desired comfort level, rotate thermostat knob counter-clockwise until the thermostat clicks off. (Note that the fan delay will keep the fan running until the elements cool.) Heater will cycle on and off to maintain room temperature.

NOTE: The first time you operate the unit, it may smoke slightly. This is due to the residual cleaning agents used to clean the element when the heater is manufactured. This is normal and does not indicate a problem with the unit. This condition will stop after the heater has been in operation for a few minutes.

Automatic Fan Delay: The UH-524TA has an automatic fan delay. When the thermostat calls for heat, fan action is delayed momentarily until the heating elements warm. This prevents the circulation of cold air. When the heater raises the temperature of the room to the thermostat set point, the heating element is turned off but the fan will continue to run until the heating element cools down. This prevents exposing the unit to residual heat, provides a higher comfort level and prolonged element life.

Thermal Cutout: The UH-524TA is also equipped with a thermal cutout which will automatically shut off the heater in the event of overheating. The heater will turn on when the operating temperature returns to normal. Should the unit overheat and activate the thermal cutout cycle, the cause of the overheating should be determined before further operation.

NOTE: If the unit is installed in an area where the temperature is below 50° F, the fan may cycle on and off until the temperature in the room rises above 50° F, this is normal and does not indicate a problem with the unit. As soon as the heater warms the air in the room above 50°, the unit will cycle normally.

SETTING THERMOSTAT

Adjusting Air Flow Direction

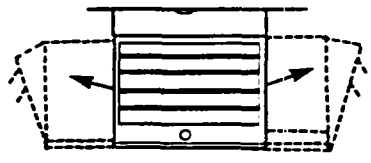
You can adjust the direction of air flow by:

A. Turning the unit. If the unit has been installed with a single lag bolt, as shown in the Figure 6, simply turn the entire unit as needed to adjust air flow.

B. Tilting the unit. Loosen the bracket screws, tilt the heater to the desired position, and re-tighten the bracket screws (see Figure 4).

NOTE: To tilt the heater it must be mounted in bottom keyhole slots of mounting bracket to maintain adequate clearance and prevent possible overheating.

Figure 6



C. Adjusting the louvers to the desired position.

NOTE: The louvers are designed so they can not be completely closed. Do not attempt to defeat this feature, damage to the unit can result.

ADJUSTING HEAT OUTPUT

Heat output can be increased or decreased by switching wires at the wattage change terminal board. The heater is factory wired to deliver a heat output of 17,065 BTU per hour. Should your particular application require less heat output, refer to Table 1 below and change the wires at the wattage change terminal board as shown in Wiring Diagram Fig. 7.

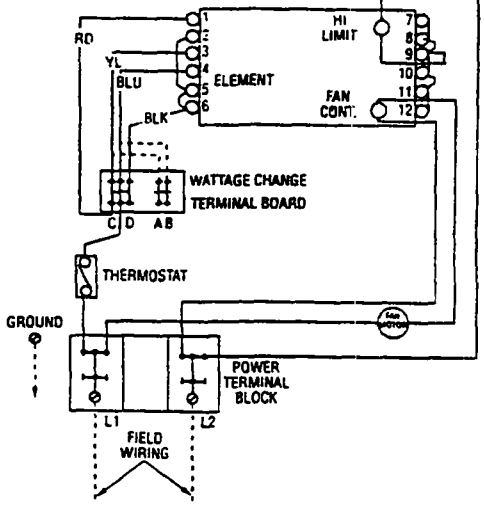
⚠ WARNING ⚠

TO PREVENT POSSIBLE ELECTRIC SHOCK, DISCONNECT POWER TO THE HEATER AT THE MAIN SERVICE BOX BEFORE ATTEMPTING TO ADJUST THE HEAT OUTPUT OF THIS UNIT.

TABLE 1. HEAT OUTPUT ADJUSTMENTS

BTU/HR	VOLTS	WATTS	MAX FUSE SIZE	HEATER AMPS	MOVE JUMPERS FROM C-D TO A-B
17065	240	5000	30	20.9	NONE
14215	240	4165	25	17.4	BLUE
11365	240	3332	20	13.9	BLUE & YELLOW
8533	240	2500	15	10.4	BLUE, YELLOW & RED
12799	208	3750	25	18.0	NONE
10659	208	3123	20	15.0	BLUE
8533	208	2500	15	12.0	BLUE & YELLOW
6396	208	1874	15	9.0	BLUE, YELLOW & RED

Figure 7



MAINTENANCE

Because of its rugged design, superior engineering, and high-quality craftsmanship, the UH-524TA requires little maintenance. With proper care, your electric heater should last a lifetime, but seasonal cleaning is recommended to maintain the efficiency of the heater.

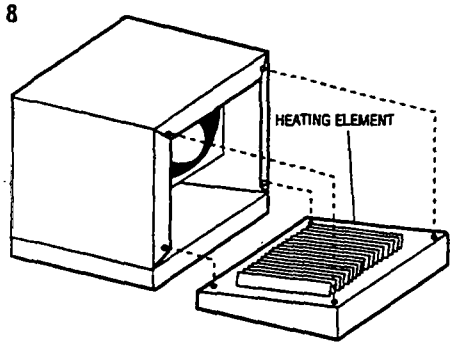
⚠ WARNING ⚠

TO PREVENT POSSIBLE ELECTRICAL SHOCK, ALL POWER MUST BE SHUT OFF AT THE MAIN SERVICE BEFORE INSPECTING OR CLEANING.

Cleaning the Heating Element

To clean the heating element, loosen (but do not remove) the four Phillips head screws located behind the louvers in the corners of the louver housing. (See Fig. 8) Grasp the louver housing on both sides, lift up, and pull out. This provides access to the heating element. Remove dust or lint with a soft brush or a vacuum cleaner. Replace the louver housing and tighten the Phillips head screws.

Figure 8



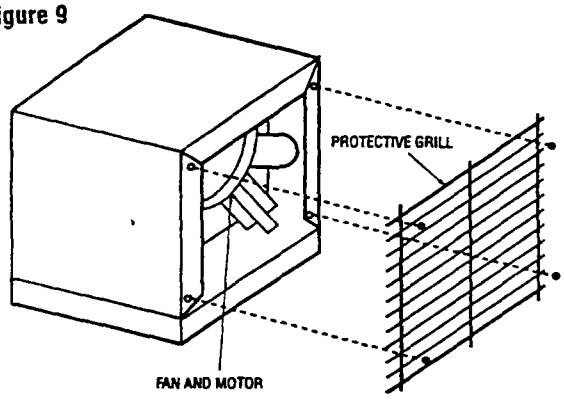
⚠ CAUTION ⚠

USE CARE TO PREVENT DAMAGE TO INTERNAL HEATER WIRING WHEN CLEANING ELEMENT. MAKE SURE ALL CONNECTIONS REMAIN TIGHT AND ALL WIRING IS ROUTED AWAY FROM ELEMENT FINS WHEN REASSEMBLING THE UNIT. ALLOWING WIRING TO TOUCH THE ELEMENT FINS COULD RESULT IN A FIRE HAZARD.

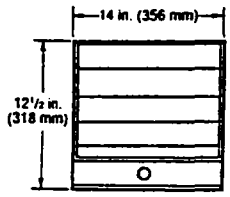
Cleaning the Fan and Motor

Remove the protective grille from the rear of the heater. This provides access to the fan and motor. Wipe off the fan and motor with a soft cloth or brush. The fan motor does not require lubrication. Replace protective grille. (See Fig. 9.)

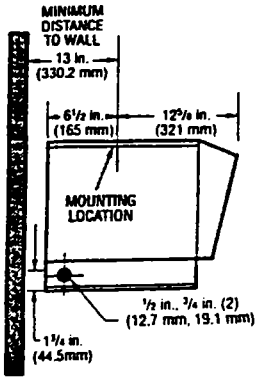
Figure 9



Dimension Data



FRONT VIEW



SIDE VIEW

SPECIFICATIONS

Heater Rating and Voltage	BTU per Hr.	Phase	Contactor Built-in	Mounting Height, ft. (mm)				Horizontal Air Throw, ft. (mm)	Min. Distance from Mounting Hole to Wall, in (mm)
				Vertical Installation		Horizontal Installation			
				Min.	Max.	Min.	Max.		
*5000 W @ 240V	17,065								
4165W @ 240V	14,215	1	No	6'	11'	6'	8'	18'	**13"
3332W @ 240V	11,365			(1829)	(3353)	(1829)	(2438)	(5472)	(330)
2500W @ 240V	8,533								
*3750W @ 208V	12,799								
3123W @ 208V	10,659	1	No	6'	11'	6'	8'	18'	**13"
2500W @ 208V	8,533			(1829)	(3353)	(1829)	(2438)	(5472)	(330)
1874W @ 208V	6,396								

*Heater is shipped from factory wired for these wattages. Heater can be field adjusted to the other wattages (Refer to "Adjusting the Heat Output" on page 4)
**48" (1219 mm) when heater air flow is between 45° downward and vertical.

LIMITED WARRANTY

products manufactured by Marley Electric Heating are warranted against defects in workmanship and materials for one year from date of installation, except heating elements which are warranted against defects in workmanship and materials for five years from date of installation. This warranty does not apply to damage from accident, misuse, or alteration; nor where the connected voltage is more than 5% above the nameplate voltage; nor to equipment improperly installed or wired or maintained in violation of the product's installation instructions. All claims for warranty work must be accompanied by proof of the date of installation.

The customer shall be responsible for all costs incurred in the removal or reinstallation of products, including labor costs, and shipping costs incurred to return products to Marley Electric Heating Service Center. Within the limitations of this warranty, inoperative units should be returned to the nearest Marley authorized service center or the Marley Electric Heating Service Center, and we will repair or replace, at our option, at no charge to you with return freight paid by Marley. It is agreed that such repair or replacement is the exclusive remedy available from Marley Electric Heating.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESAID EXPRESSED WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS AGREEMENT. MARLEY ELECTRIC HEATING SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES ARISING WITH RESPECT TO THE PRODUCT, WHETHER BASED UPON NEGLIGENCE, TORT, STRICT LIABILITY, OR CONTRACT

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

For the address of your nearest authorized service center, contact Marley Electric Heating in Bennettsville, SC, USA, at 1-800-642-4328. Merchandise returned to the factory must be accompanied by a return authorization and service identification tag, both available from Marley Electric Heating. When requesting return authorization, include all catalog numbers shown on the products.

HOW TO ORDER REPAIR PARTS

In order to obtain any needed repair or replacement parts, warranty service or technical information, please contact Marley Electric Heating Service Center toll-free by calling 1-800-642-HEAT.

When ordering repair parts, always give the information listed as follows:

1. The Model Number
2. The Part Description
3. Date of Manufacture

Marley Electric Heating
A United Dominion Company
470 Beauty Spot Rd. East
Bennettsville, SC 29512 USA

Part No: 5200-2252-000
SWO 259
05/95

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Heavy Duty Ring Frame Fan

Description

Dayton heavy duty ring frame fans are used in various types of applications such as: cooling electrical equipment, ventilating small rooms and enclosures, etc. Construction features include a steel angle ring frame and heavy gauge steel motor mounting platform. The motor is a shaded pole, totally-enclosed type with a resilient base attachment, and includes an external junction box for wiring convenience. The aluminum blade is embossed for extra rigidity and long life. Six mounting holes are provided for ease on installation.

Unpacking

1. Inspect for any damage that may have occurred in transit.
2. Shipping damage claim must be filed with carrier.

General Safety Information

1. Follow all local electrical and safety codes, as well as the national electrical code, and the occupational safety and health act.
2. If the unit is mounted less than seven feet from the floor, guarding may be required by OSHA.
3. Make certain power source conforms to the motor requirements.
4. Always disconnect the power source before attempting to service the fan.
5. Protect the power cord from coming in contact with sharp edges or other objects.
6. Do not kink the power cord or allow it to come in contact with oil, grease, hot surfaces, or chemicals.

Specifications

Blade Dia.	CFM Free Air	Motor HP	RPM	Full Load Amp	Volts/Hz.	Lead Length
12"	1075	1/20	1550	1.9	115V/60 Hz	6"

Installation

1. The unit preferably should be mounted to a plywood panel that has been securely anchored to the wall studs or frame of the enclosure. use 5/8" or thicker plywood.
2. Cut the circular opening using a sabre saw or keyhole saw. The diameter should be 13 3/4". Do NOT cut the opening until you measure the diameter of the frame, a close fit around the frame is desirable.
3. Mount the fan to the panel using No. 10 wood or sheet metal screws, or bolts and nuts. If the fan is mounted to a sheet metal panel the panel should be reinforced with a flat washer and bolts and nuts used for mounting.
4. Install any auxiliary equipment such as a motor control etc.
5. Wire the unit following all local and national electrical codes.

⚠ CAUTION ***The motor and fan should be connected to a suitable electrical ground.***

6. Before operating, insure there are no obstructions which could interfere with the fan blades.

Operation

Keep the area free of objects that could impede air flow on both the intake side and exhaust side of the fan.

Maintenance

⚠WARNING ***Make certain that the power source is disconnected and fan blade has stopped rotating before attempting to service or disassemble any components! If the power disconnect is out-of-sight, lock it in the open position and tag to prevent application of power.***

MINOR AND ROUTINE

1. Lubrication: Re-lubricate the motor bearings every six months using S.A.E. 20 non-detergent oil.
2. Cleaning: Periodically clean the fan blade and motor of any accumulated dust and dirt. Use a vacuum to remove dirt from the motor enclosure.

PARTS REPLACEMENT

1. Refer to the illustration for parts location The unit can be disassembled by loosening the blade setscrew and the four nuts holding the motor base to the mounting platform.
2. When reassembling the blade should be flush with the motor shaft and the setscrew centered over the flat of the shaft.

NOTE: Do not repair damaged fan blades. Replace the fan blade to prevent it from becoming a safety hazard.

For Replacement Parts, call 1-800-323-0620

Please provide following information:
-Model number
-Serial number (if any)
-Part descriptions and number as shown in parts list

Address parts correspondence to:
Parts Company of America
1657 Shermer Road
Northbrook, IL 60062-5362

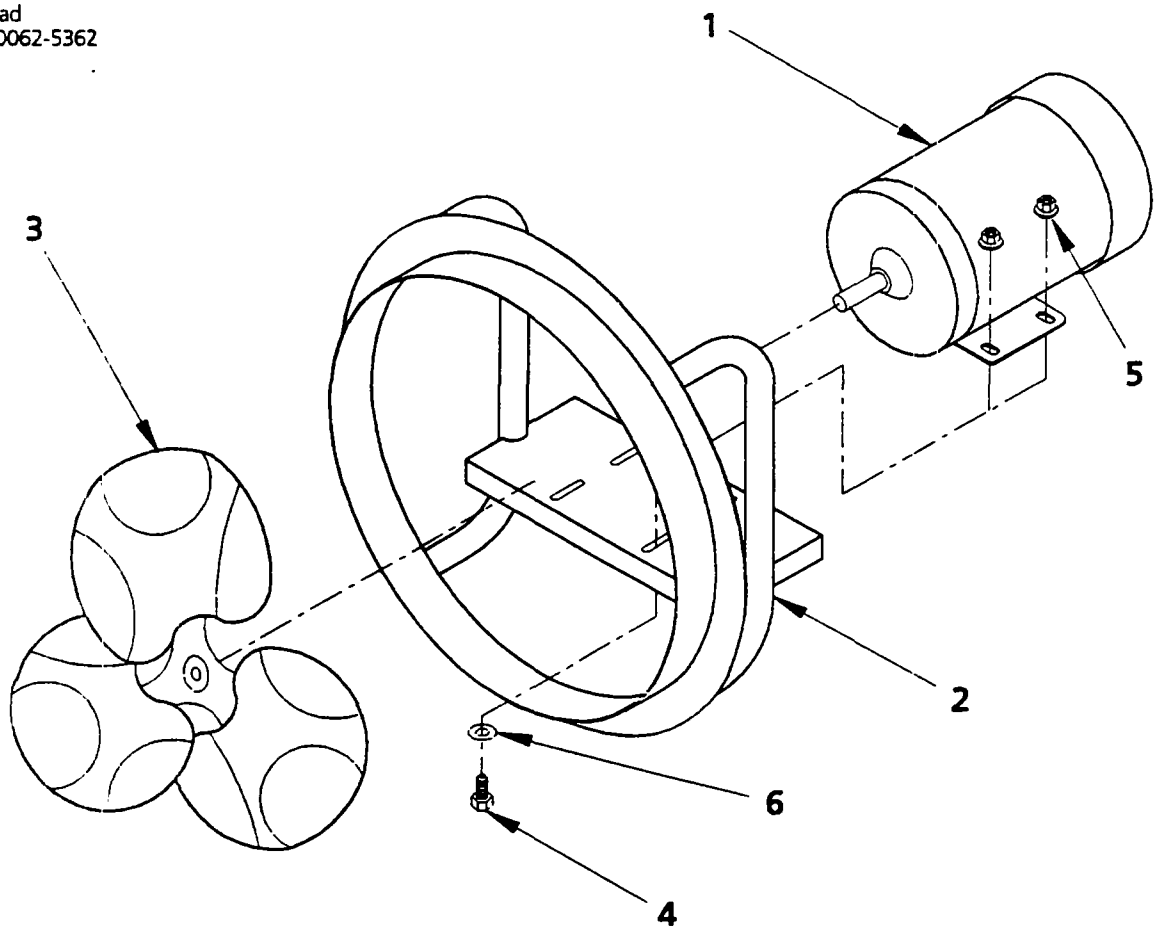


Figure 1 — Replacement Parts Illustration

Replacement Parts List

Reference Number	Description	Part Number	Quantity
1	Motor	13002002	1
2	Angle ring frame	42088002	1
3	Fan blade	03146002	1
4	1/4-20 x 1/2" Screw	*	4
5	1/4-20 Spinlock nut	*	4
6	1/4" Flat washer	*	4

(*) Standard hardware items, available locally.

Dayton® Heavy Duty Ring Frame Fan

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Insufficient air flow	1. Restriction too high	1. Provide opening for air intake and exhaust
	2. Low voltage	2. Determine cause and correct
Excessive noise while operating	1. Excessive dirt on fan blade	1.Clean
	2. Loose fan blade	2. Tighten setscrew
	3. Noisy motor bearing	3. Lubricate
	4. Loose frame mounting bolt	4. Tighten securely
Motor turning on mounting base	Loose resilient ring clamps	Tighten

Service Record

Dayton® Heavy Duty Ring Frame Fan

Date	Maintenance performed	Replacement components required

Dayton® Heavy Duty Ring Frame Fan

Limited Warranty

Dayton One-Year Limited Warranty. Heavy Duty Ring Frame Fan, Model 2C100C is warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see PROMPT DISPOSITION below. This limited warranty gives purchasers specific legal rights which vary from state to state.

Limitation of Liability. To the extent allowable under applicable law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to and shall not exceed the purchase price paid.

Warranty Disclaimer. Dayton has made a diligent effort to illustrate and describe the product in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the product is merchantable, or fits a particular purpose, or that the product will necessarily conform to the illustrations or descriptions.

Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in the "LIMITED WARRANTY" above is made or authorized by Dayton.

Product Suitability. Many states and localities have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, please review the product application, and national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some states do not allow a limitation on how long an implied warranty lasts, consequentially the above limitation may not apply to you; and (c) by law, during the period of this limited warranty, any implied warranty of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 U.S.A.

Printed in U.S.A.
05580
0794/266/VCPVP

Dayton®

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Intake Guards

Description

Dayton Intake Guards are to be used with Dayton 12 thru 30" direct-drive and 24 thru 60" belt-drive exhaust fans. These guards are strongly recommended for use on fans located in any area accessible to personnel or where there is a possibility of loose objects being drawn into the fan. All intake guards comply with OSHA regulations. Each unit consists of four (4) side panels, perforated guard, and assembly hardware. All guards have a galvanized finish.

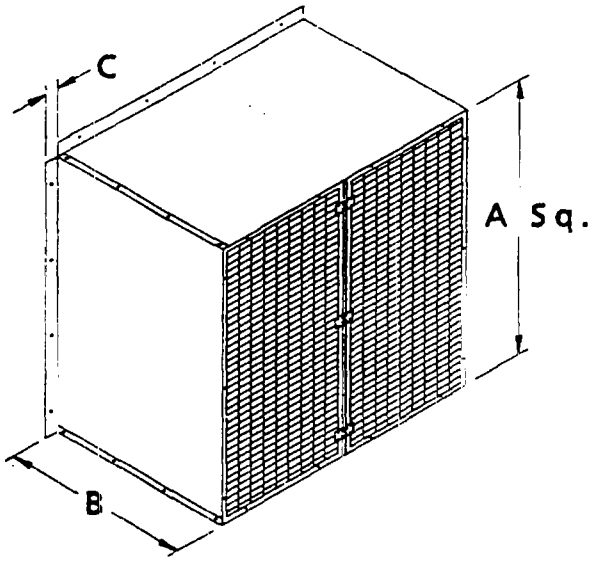


Figure 1 - Overall Dimen...

Specifications

Model	Fan Size	Dayton Stock No.	Dimensions A	B	C	Guard Grid Sections	Side Panel Gage	Total Free-Area % Opening
6D581	12"	4C545*	16 1/8"	13	1 1/4"	1	20	85
6D582	16	4C546*	20 1/8	13	1 1/4	1	20	85
6D583	18	4C547*	22 1/8	13	1 1/4	1	20	85
6D584	20	3C304*	24 1/8	14	1 1/4	1	20	85
6D585	24	3C305* 3CC73 5C193	28 1/8	20	1 1/2	1	20	85
6D586	30	3C378* 3CC74 5C194	34 1/8	20	1 1/2	1	20	85
6D587	36	3CC75 3CC78 3C606 3C705	40 1/8	27	2	2	20	85
6D588	42	3CC76 3C607 3C706	46 1/8	30	2	2	20	85
6D589	48	3CC77 3C608 3C707	54 1/4	32	2	2	18	85
6D590	54	3C671 3C708	60 1/4	34	2	2	18	85
6D591	60	3C609 3C709	66 1/4	37	2	2	18	85

(*) Venturi frame listed. Contact Grainger for motors and fan blades.

Dayton® Intake Guards

General Safety Information

⚠WARNING ***Intake guards to be used in conjunction with exhaust fans. Care should be taken to ensure that power source to fan is locked off before intake guard is installed so that the fan creates no hazard to installer.***

⚠ CAUTION ***Intake guard complies with OSHA regulations. Make sure intake guard is securely in place before placing fan into operation.***

Installation

INTAKE GUARD HOUSING FOR EXHAUST FANS

Important: Fan should be securely mounted to wall prior to installation of intake guard housing.

1. Bolt (4) side panels together with 1/4 dia. x 1/2" long bolts and lock nuts (supplied).
2. Fasten housing to wall or directly to fan frame; hardware not supplied. a) Use 1/4" x 2" masonry anchor for masonry walls. b) Use 1/4 x 2" lag screw if fastening to a frame wall. c) If fastening directly to fan frame, which is already mounted on wall, use 1/4-20 x 1/2" bolts and nuts.
3. Install center channel post with #10 x 1/2" sheet metal screws (supplied) on sizes 36" or larger which have two piece guards. Post not required with 12 thru 30" models which have a single grid.
4. Fasten intake guard to face of housing with hinges and #10 x 1/2" sheet metal screws (supplied) See Figure 3.

Maintenance

⚠ CAUTION ***Make certain that the power source is disconnected before attempting to service or disassemble any components! If the power disconnect is out-of-sight, lock it in open position and tag to prevent application of power.***

CLEANING

Clean intake guard and housing of any accumulated dirt which would restrict air flow.

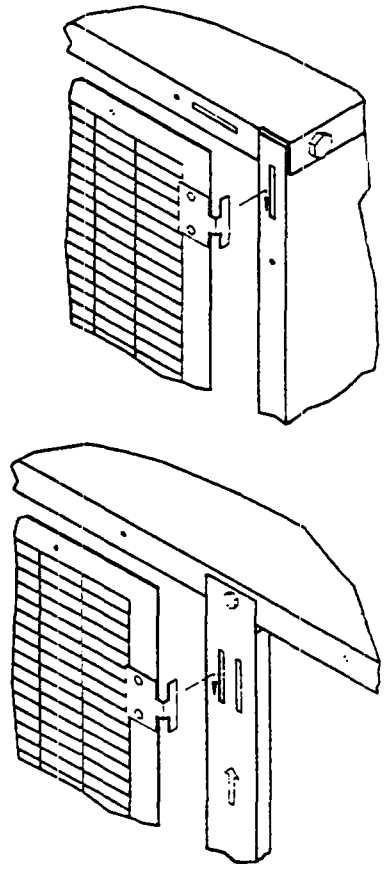


Figure 3 - Assembly of Hinges

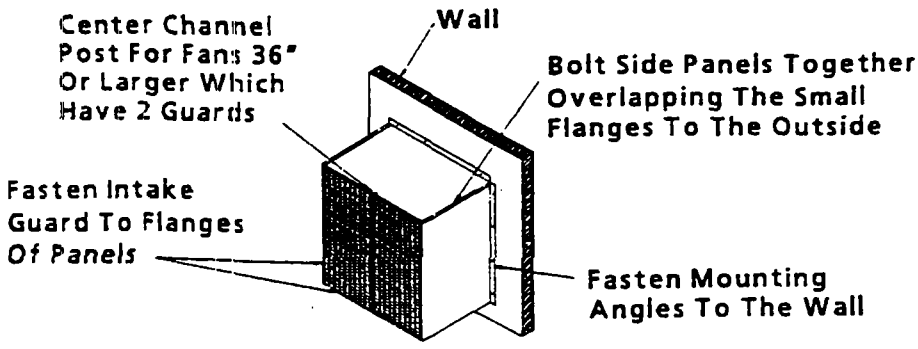


Figure 2 - Illustration

For Replacement Parts, call 1-800-323-0620

Please provide following information:
Model number
-Serial number (if any)
-Part descriptions and number as shown in parts list

Address parts correspondence to:
Parts Company of America
1657 Shermer Road
Northbrook, IL 60062-5362

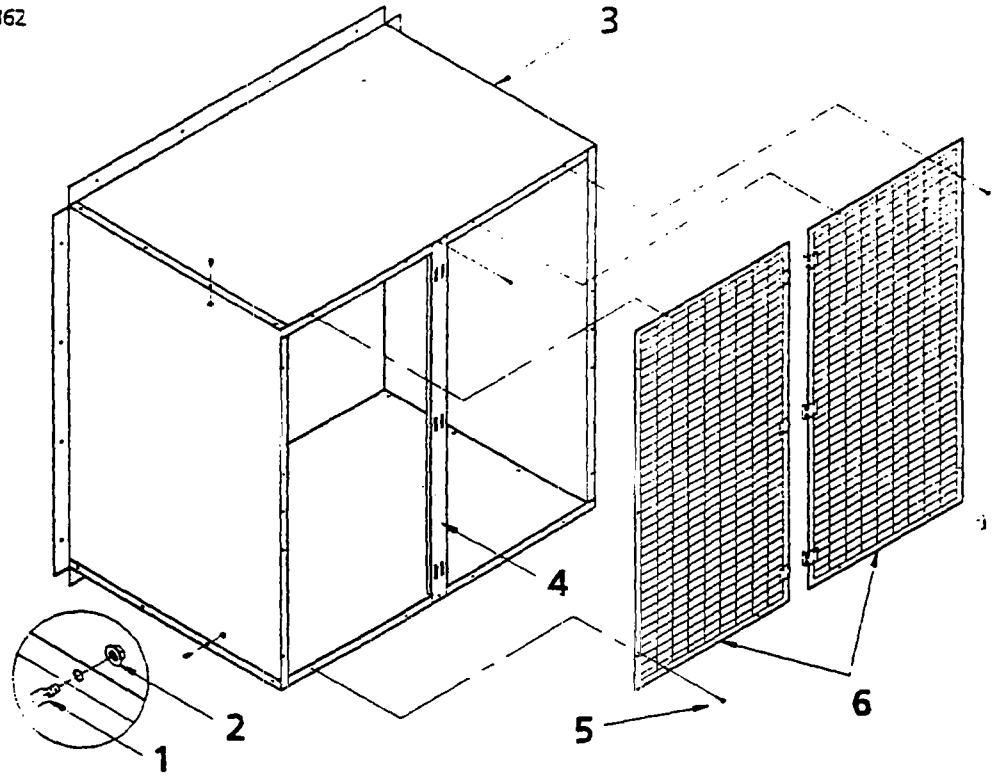


Figure 4— Replacement Parts Illustration

Replacement Parts List

Ref. No.	Description	Part Number For Models: 6D581	6D582	6D583	6D584	6D585	6D586	Qty.
1	1/4-20x1/2" bolt	*	*	*	*	*	*	12
2	1/4"-20 locknut	*	*	*	*	*	*	12
3	Side panel	90262001	90263001	90264001	90265001	90266001	90267001	4
4	Channel support	—	—	—	—	—	—	1
5	10x1/2" SM screw	*	*	*	*	*	*	6 to 9
6	Guard assembly	90289001	90290001	90291001	90292001	90293001	90294001	1

(*) Standard hardware items, available locally.

Ref No.	Description	Part Number For Models: 6D587	6D588	6D589	6D590	6D591	Qty.
1	1/4-20 x 1/2" bolt	*	*	*	*	*	16
2	1/4"-20 locknut	*	*	*	*	*	16
3	Side panel	90268001	90269001	90270001	90271001	90272001	4
4	Channel support	90273001	90274001	90275001	90276001	—	1
5	10x1/2" SM screw	*	*	*	*	*	16 to 26
6	Guard assembly	90295001	90296001	90297001	90298001	90299001	2

(*) Standard hardware items, available locally.

Dayton® Intake Guards

Limited Warranty

Dayton One-Year Limited Warranty. Intake Guards, Models 6D581 thru 6D591, are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see PROMPT DISPOSITION below. This limited warranty gives purchasers specific legal rights which vary from state to state.

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Manufactured for Dayton Electric Mfg. Co.
Niles, Illinois 60714 U.S.A.

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05580
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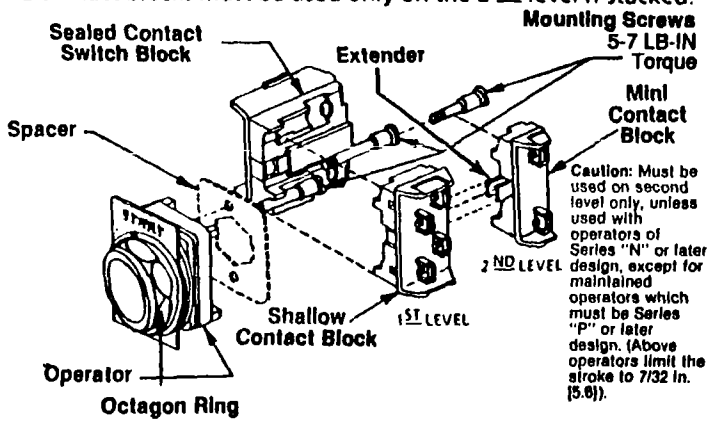
Dayton®

INSTRUCTIONS

Bulletin 800T, Shallow, Mini And Sealed Switch Contact Blocks

The contact blocks of the sealed switch, shallow and mini construction cannot be mixed with the 1-5/8 inch deep (Series A) construction contact block. A sealed switch contact block may be mounted on either or both sides of an operator, one deep only (no other contact blocks on that side). A shallow contact block may be mounted on either or both sides of an operator, two deep maximum or in conjunction with a mini contact block on the second level. A sealed switch contact block may be mounted on one side with shallow and mini contact blocks on the other side, observing above restrictions. Each additional contact block will contain enough mounting hardware to mount one block. When mounting two or more contact blocks discard all excess hardware. Contact block retaining clips cannot be used with an XA1, XA2, XA4, XA7 and a sealed contact switch block.
XA2 contact blocks must be used only on the 2 ND level if stacked.



Note:

1) Contact blocks used on operators with projections at four corners of adapter plate must be mounted without spacer.

2) Contact blocks used on operators without projections must be mounted with one spacer.

Caution: Extender ... not be used whe... mounted directly ... operator; extender ... easily removed. Ext... must be used when ... is mounted in tander... illustrated.

(Continued on other side)

40060-226-01 (G)
Printed in U.S.A.

ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL

NOTE: The sealed switch contact block contacts are hermetically sealed in a glass envelope. Dust, dirt, oxidation, oil laden air, or other air-borne contaminants do not affect the continuity of the contacts. The contacts of the shallow and mini contact blocks and the operating mechanism of all the blocks are not sealed, however, and must be protected by an enclosure and an external operator suitable for the environment. Contact blocks must be protected from dirt or contamination that might enter enclosures during installation, maintenance or any time the enclosure is open. Never blow dirt off of electrical components, as this may force dirt into internal mechanisms - use vacuum.

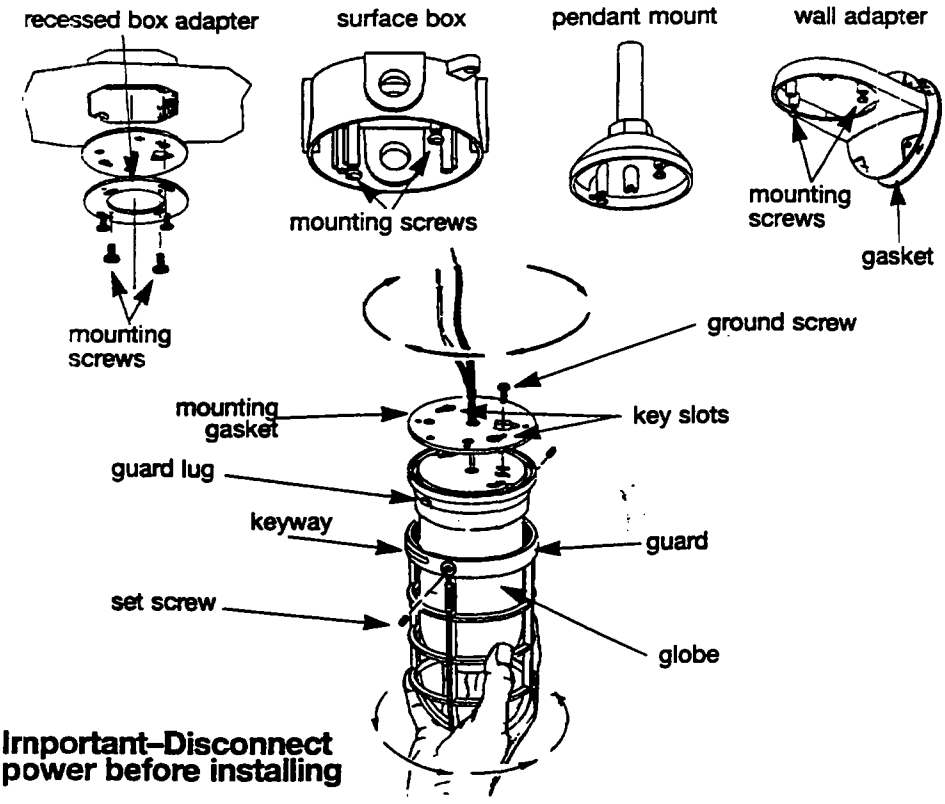
Sealed switch contact blocks can be used with any operator except the following (these operators are not mechanically compatible with the sealed switch contact blocks):

800T - T 2, 3, 4 Way Switch Series P and older
800T - K Selector Push Button

IMPORTANT - DO NOT USE
Catalog Number 800T - XD3 Contact Block with the following Selector Switch Operators:

Cat. No. 800T - J_KE7
Cat. No. 800T - J_KR1
Cat. No. 800T - J_KR7
Cat. No. 800T - J_KT1
Cat. No. 800T - J_KT7
Cat. No. 800T - J_KU7
Cat. No. 800T - N_KK4
Cat. No. 800T - N_KM4
Cat. No. 800H - JR_KE7
Cat. No. 800H - JR_KR1
Cat. No. 800H - JR_KR7
Cat. No. 800H - JR_KT1
Cat. No. 800H - JR_KT7
Cat. No. 800H - JR_KU7
Cat. No. 800H - NR_KK4

Mounting Instructions for roughlyte™ vaportight HID fixtures



Important–Disconnect power before installing

1. Install desired mounting fitting, i.e., recessed box adapter, surface box, pendant or wall adapter.
2. Install (supplied) mounting screws to desired fitting a few turns.
3. Slip mounting gasket over socket adapter leads and line up mounting key slots. Insure that ground screw opening lines up with grounding pads.
4. Connect supply leads to socket leads per NEC. Connect supply ground wire to grounding pads with screw supplied.
5. Twist socket adapter up over mounting screws. Tighten mounting screws.
6. Install lamp and globe.
7. Slip guard (optional) up and over globe, lining up keyways in guard with guard lugs on socket adapter. Turn clockwise until tight. Install set screws and tighten.

STONCO 2345 Vauxhall Rd., Union, NJ 07083 UN-59-01619-000 12/94

Thank you for buying Stonco's new, re-designed roughlyte™ vaportight fixture.

We re-designed the roughlyte™ vaportight to make your job easier. Our aim at Stonco is to design contractor friendly products for you.

We'd like to hear your comments. Call us at 800-334-2212 or FAX (908) 964-1404
Att: Marketing Department

10.15) MISCELLANEOUS

BUILDING CONTAINMENT LIP CAPACITY
AIR ELIMINATOR
SYSTEM CHLORINATOR
CHLORINE DRIP UNITS

BUILDING CONTAINMENT LIP CAPACITY

INSIDE BUILDING DIMENSIONS - 13' - 4" x 7' - 4"

CONTAINMENT LIP DEPTH - 3"

VOLUME = 13' - 4" x 7' - 4" x 3" = 42,240 CUBIC INCHES = 182.9 GALLONS

THEREFORE THE BUILDING CONTAINMENT CAPACITY IS APPROXIMATELY

180 GALLONS

CARBON VESSEL WATER CAPACITY

400 LB VESSEL HAS A VOLUME OF 17.2 CUBIC FEET

400 LBS OF VAPOR PHASE CARBON @ 25 LBS/CU. FT. = 16 CUBIC FEET

17.2 CU.FT. - 16 CU. FT. = 1.2 CU. FT. OF VOLUME TO HOLD WATER.

OF THE 400 LBS OF CARBON IN THE VESSEL, 20% OF THAT VOLUME WILL BE POROSITY OR OPEN SPACE WHICH WILL HOLD WATER.

16 CU. FT. X 20 % = 3.2 CU. FT.

OPEN VOLUME IN A 400 LB VESSEL WHICH CAN HOLD WATER

1.2 CU. FT. + 3.2 CU. FT. = 4.4 CU. FT. X 7.48 GALLONS/CU. FT.
= 32.9 GALLONS PER VESSEL

600 LB VESSEL HAS A VOLUME OF 26 CUBIC FEET

600 LBS OF VAPOR PHASE CARBON @ 25 LBS/CU. FT. = 24 CUBIC FEET

26 CU.FT. - 24 CU. FT. = 2 CU. FT. OF VOLUME TO HOLD WATER.

OF THE 600 LBS OF CARBON IN THE VESSEL, 20% OF THAT VOLUME WILL BE POROSITY OR OPEN SPACE WHICH WILL HOLD WATER.

24 CU. FT. X 20 % = 4.8 CU. FT.

OPEN VOLUME IN A 600 LB VESSEL WHICH CAN HOLD WATER

2 CU. FT. + 4.8 CU. FT. = 6.8 CU. FT. X 7.48 GALLONS/CU. FT.
= 50.9 GALLONS PER VESSEL

BUILDING CONTAINMENT LIP CAPACITY CONTINUED

2" DIA. PVC PIPING WATER CAPACITY

2" DIA. PIPE, AREA = 3.14 SQ. IN.

APPROX. 74 FT OF 2" PIPE AND HOSE IN THE SYSTEM, = 888 INCHES

CAPACITY = 3.14 SQ. IN. x 888 IN. = 2,788 CU. IN. = 12.07 GALLONS

8-15 ROSEDALE FILTER WATER CAPACITY

ROSEDALE FITER VOLUME = 500 CU. IN. = 2.2 GALLONS

400 LB SYSTEM TOTAL SPILL CAPACITY (GALLONS)

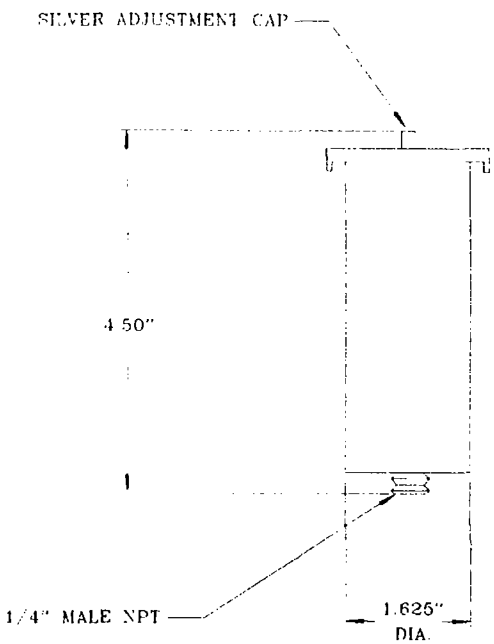
WATER CAPACITY = (2) VESSELS + PIPING + ROSEDALE FILTER
= (2) 33 GAL. + 12 GAL. + 2.2 GAL.
= 80.2 GALLONS

600 LB SYSTEM TOTAL SPILL CAPACITY (GALLONS)

WATER CAPACITY = (2) VESSELS + PIPING + ROSEDALE FILTER
= (2) 51 GAL. + 12 GAL. + 2.2 GAL.
= 116.2 GALLONS

BUILDING CONTAINMENT LIP WATER CAPACITY = 180 GALLONS
400 LB SYSTEM WATER CAPACITY = 80.2 GALLONS
600 LB SYSTEM WATER CAPACITY = 116.2 GALLONS

THEREFORE THE BUILDING CONTAINMENT LIPS WILL BE ABLE TO HOLD A TOTAL SPILL FROM EITHER SIZED SYSTEM.



THE AIR ELIMINATOR, ON TOP OF EACH OR THE LIQUID PHASE CARBON VESSELS, IS A DEVICE USED TO LET EXCESS AIR IN THE SYSTEM TO BE VENTED TO ATMOSPHERE WITHOUT HUMAN INTERVENTION.

EXCESS AIR GETS INTO THE SYSTEM THROUGH EVERY DAY NORMALL OPERATIONAND DURING CARBON CHANGE-OUTS. THIS DEVICE IS USED TO LEASE THIS EXCESS AIR.

THE SILVER CAP ON TOP OF THE AIR ELIMINATOR IS USED TO ADJUST HOW FAST, IF ANY, THE AIR IS TO BE RELEASED FROM THE SYSTEM. TIGHTENING OF THE CAP REDUCES THE AMOUNT OF AIR RELEASED FROM THE ELIMINATOR. (THE ELIMINATOR SHOULD HAVE BEEN SET AT START-UP AND SHOULD NEED NO ADJUSTMENT.)

NOTE

THE DESIGN, SPECIFICATIONS AND INFORMATION CONTAINED IN THIS DRAWING IS PROPRIETARY INFORMATION WHICH IS FOR THE SOLE, EXCLUSIVE USE OF GREAT LAKES CARBON TREATMENT, INC. THE INFORMATION AND SPECIFICATIONS CONTAINED HEREIN MAY NOT BE DUPLICATED IN ANY MANNER SHAPE OR FORM WITHOUT THE WRITTEN CONSENT OF GREAT LAKES CARBON TREATMENT, INC.

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

AIR ELIMINATOR

SCALE: NONE	TOLERANCES	DRAWN BY:
DATE: [illegible] NOV 1994		S. KRELLWITZ
SHEET	ENGINEER	DR. NUMBER AIRELIM

Great Lakes Carbon Treatment Inc.

3300 US-131 North
P.O. Box 968
Kalkaska, MI 49646
1-800-258-8014
PHONE (616) 258-8014
FAX (616) 258-6993

1617 Pratt Avenue
Marshall, MI 49068
1-800-841-8324
PHONE (616) 781-1063
FAX (616) 781-8241

HIGH PRESSURE CHLORINATOR

Chlorinator Chlorine Capacity - 2 lbs

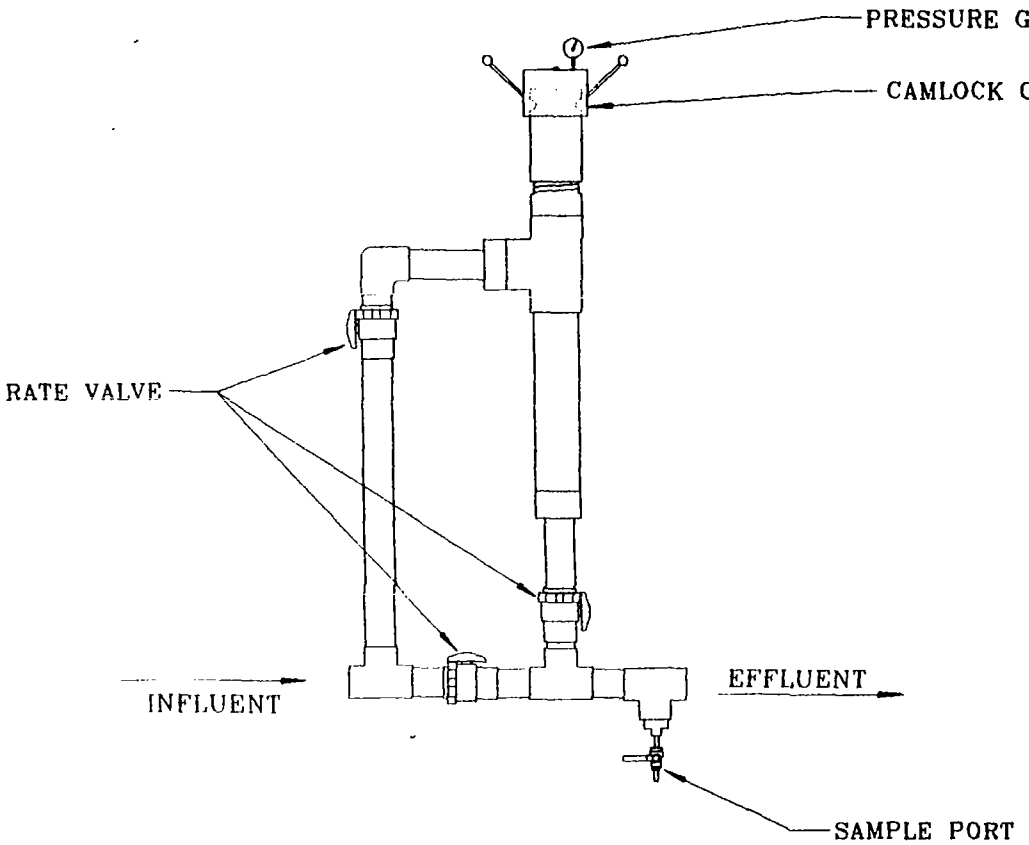
Adjustable Treatment Rate - Recommended 2ppm treatment.

Approx. time between chlorine refills (treatment @ 2 ppm) - 4 to 6 months.

Chlorine is used in a system to remove bacterial growth, which when in a system with heavy amounts of iron, will develope a slim which coats the carbon and reduce it's effectiveness.

The chlorine used in the treatment of the bacteria will be adsorbed by the carbon prior to the discharge point of the system. The chlorine will decay in to a salt form once it is adsorbed into the carbon. The carbons effectiveness at adsorbing contamination will not be effected by the chlorine.

The use of activated carbon to remove chlorine from Food Processing Water is used in the Food Industry through out the country and is well documented.



PROPRIETARY INFORMATION

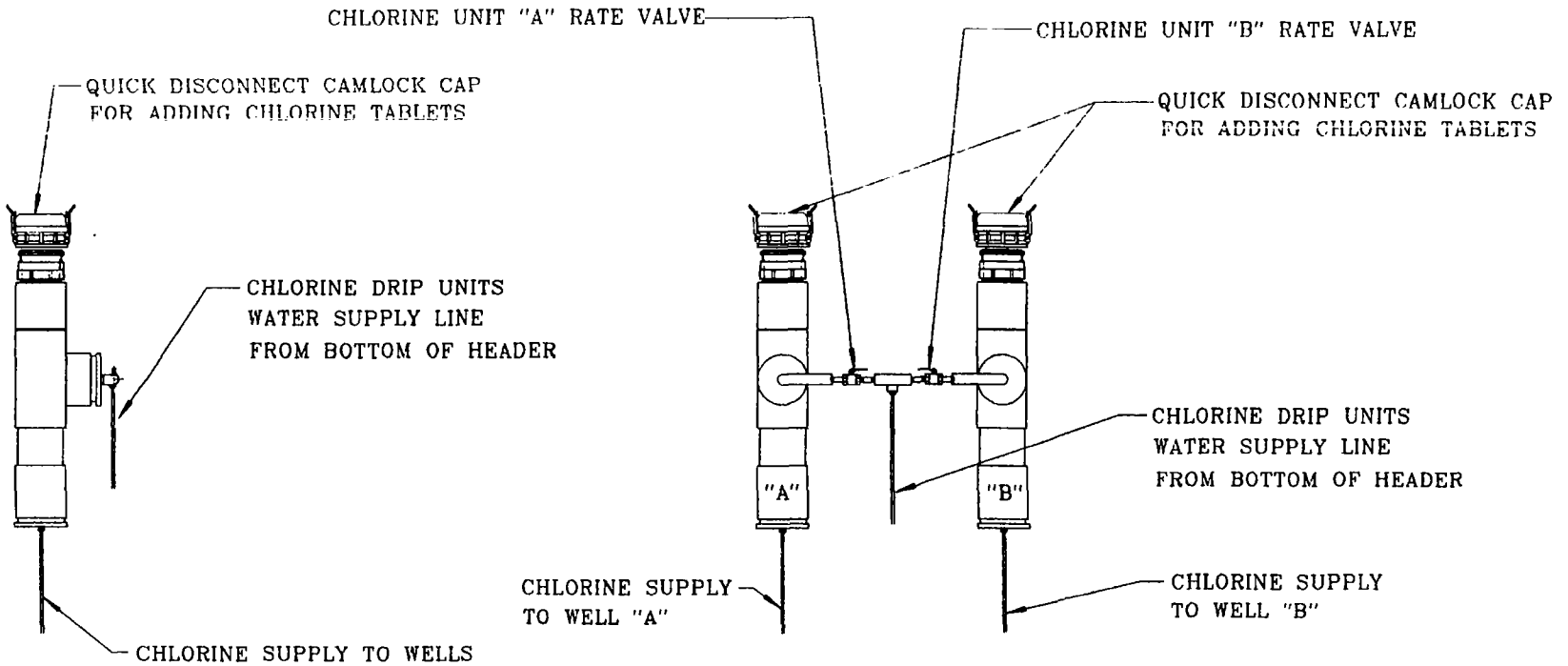
MATERIAL: SCHEDULE 40 PVC
(HIGH PRESSURE)

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
185 EAST M-72
KALKASKA, MICH. 49646

CHLORINATOR

SCALE: NONE	TOLERANCES: XX ±	DRAWN BY:
DATE: 18 FEB 1993		B. KRELWITZ
SHEET 1 OF 1	ENGINEER LEON L. GULETT, PE	DR. NUMBER:



INDIVIDUAL WELL CHLORINE DRIP UNITS

ADJUSTABLE TREATMENT RATE- RECOMMENDED 2 ppm TREATMENT

CHLORINE IS USED TO REMOVE BACTERIAL GROWTH, WHICH WHEN IN A SYSTEM WITH HEAVY AMOUNTS OF IRON, WILL DEVELOPE A SLIM WHICH COATS THE CARBON AND REDUCES THE CARBONS EFFECTIVENESS.

TO TREAT WEEL "A", TURN WELL"A" OFF, TURN WATER SUPPLY ON, CRACK CHLORINE UNIT "A" RATE VALVE, AND LET RUN FOR DESIRED AMOUNT OF TIME.

TO TREAT WELL "B", TURN WELL "B" OFF, TURN WATER SUPPLY ON, CRACK CHLORINE UNIT "B" RATE VALVE, AND LET RUN FOR DESIRED AMOUNT OF TIME.

ISSUE	DATE	DESCRIPTION	APPROVED

GREAT LAKES CARBON TREATMENT, INC.
3300 U.S. 131 N.E.
KALKASKA, MICH. 49646

WELL CHLORINE DRIP UNIT

SCALE: NONE	TOLERANCES: XXX	DRAWN BY:
DATE: 09 NOV 96		G. KRELLWITZ
SHEET	REVISED:	DR. NUMBER: WCU

APPENDIX D

LONG-TERM WATER TREATMENT FACILITY SAMPLING FREQUENCY

APPENDIX D
LONG-TERM WATER TREATMENT FACILITIES
SAMPLING FREQUENCY

A quarterly sampling frequency between the carbon canisters is sufficient to ensure compliance with the PCB discharge goal. To date, the concentrations of PCB in both the lead carbon and effluent samples have been non-detect, even with the portable systems that had smaller carbon canisters.

The permanent treatment systems have two equally-sized carbon vessels that each contain half the total weight of carbon for each system. The treatment systems have a flow restriction built into them that far exceeds the maximum sustainable pumping rate for the containment cells based on pumping tests. Basing the flow rate through the system on this maximum rate is therefore conservative.

The maximum concentration of PCBs in influent water detected during operation of the Category 5 systems was 14 ppb at the Slip No. 3 Containment Cell. Based on this operational history, assuming a maximum concentration of 20 ppb is also conservative. Finally, the carbon beds are assumed to have a PCB loading of two weight percent.

Using these assumptions, it would take over six years to exhaust the carbon available in the treatment systems, and over three years to exhaust the lead carbon vessel. Therefore, a quarterly sampling frequency of the permanent treatment systems should be sufficient to monitor their performance. The calculations are presented below:

Weight of carbon per system:
400 pounds - Slip No. 3 Containment Cell
600 pounds - East and West Containment Cells

Maximum water treatment flow rate to treatment systems
15 gal.per minute - Slip No. 3 Containment Cell (21,600 gpd)
20 gal.per minute - East and West Containment Cell (28,800 gpd)

Assumed maximum influent concentration
20 parts per billion

PCB Loading on Carbon:
$0.02 \frac{\text{lbs PCB}}{\text{lb carbon}}$

PCB Removal Rate, 400 lb system:

$$\frac{21{,}600 \text{ gals water}}{\text{day}} \times \frac{8.34 \text{ lbs water}}{\text{gal. water}} \times \frac{20 \text{ lbs PCB}}{1E{+}09 \text{ lbs water}} \times \frac{365 \text{ days}}{\text{year}} = 1.32 \frac{\text{lbs PCB}}{\text{year}}$$

PCB Removal Rate, 600 lb system:

$$\frac{28{,}800 \text{ gals water}}{\text{day}} \times \frac{8.34 \text{ lbs water}}{\text{gal. water}} \times \frac{20 \text{ lbs PCB}}{1E{+}09 \text{ lbs water}} \times \frac{365 \text{ days}}{\text{year}} = 1.75 \frac{\text{lbs PCB}}{\text{year}}$$

PCB Capacity of 400 Lbs. carbon:

$$400 \text{ lbs carbon} \times \frac{0.02 \text{ lbs PCB}}{\text{lb carbon}} = 8 \frac{\text{lbs PCB}}{\text{system}}$$

PCB Capacity of 600 Lbs. carbon:

$$600 \text{ Lbs. carbon} \times \frac{0.02 \text{ Lbs. PCB}}{\text{lb carbon}} = 12 \frac{\text{Lbs. PCB}}{\text{system}}$$

Time Required to achieve Carbon Loading, 400 lb System:

$$\frac{8 \text{ Lbs. PCB}}{\text{system}} \times \frac{\text{year}}{1.315 \text{ Lbs. PCB}} = 6.1 \text{ years} \quad (3.04 \text{ years for lead carbon vessel only})$$

Time Required to achieve Carbon Loading, 600 lb System:

$$\frac{12 \text{ Lbs. PCB}}{\text{system}} \times \frac{\text{year}}{1.753 \text{ Lbs. PCB}} = 6.8 \text{ years} \quad (3.42 \text{ years for lead carbon vessel only})$$

APPENDIX E

BUILDING CONTAINMENT LIP CAPACITY
CATEGORY 5 PERMANENT WATER TREATMENT SYSTEMS

BUILDING CONTAINMENT LIP CAPACITY

INSIDE BUILDING DIMENSIONS - 13' - 4" x 7' - 4"

CONTAINMENT LIP DEPTH - 3"

VOLUME = 13' - 4" x 7' - 4" x 3" = 42,240 CUBIC INCHES = 182.9 GALLONS

THEREFORE THE BUILDING CONTAINMENT CAPACITY IS APPROXIMATELY

180 GALLONS

CARBON VESSEL WATER CAPACITY

400 LB VESSEL HAS A VOLUME OF 17.2 CUBIC FEET

400 LBS OF VAPOR PHASE CARBON @ 25 LBS/CU. FT. = 16 CUBIC FEET

17.2 CU.FT. - 16 CU. FT. = 1.2 CU. FT. OF VOLUME TO HOLD WATER.

OF THE 400 LBS OF CARBON IN THE VESSEL, 20% OF THAT VOLUME WILL BE POROSITY OR OPEN SPACE WHICH WILL HOLD WATER.

16 CU. FT. X 20 % = 3.2 CU. FT.

OPEN VOLUME IN A 400 LB VESSEL WHICH CAN HOLD WATER

1.2 CU. FT. + 3.2 CU. FT. = 4.4 CU. FT. X 7.48 GALLONS/CU. FT.
= 32.9 GALLONS PER VESSEL

600 LB VESSEL HAS A VOLUME OF 26 CUBIC FEET

600 LBS OF VAPOR PHASE CARBON @ 25 LBS/CU. FT. = 24 CUBIC FEET

26 CU.FT. - 24 CU. FT. = 2 CU. FT. OF VOLUME TO HOLD WATER.

OF THE 600 LBS OF CARBON IN THE VESSEL, 20% OF THAT VOLUME WILL BE POROSITY OR OPEN SPACE WHICH WILL HOLD WATER.

24 CU. FT. X 20 % = 4.8 CU. FT.

OPEN VOLUME IN A 600 LB VESSEL WHICH CAN HOLD WATER

2 CU. FT. + 4.8 CU. FT. = 6.8 CU. FT. X 7.48 GALLONS/CU. FT.
= 50.9 GALLONS PER VESSEL

BUILDING CONTAINMENT LIP CAPACITY CONTINUED

2" DIA. PVC PIPING WATER CAPACITY

2" DIA. PIPE, AREA = 3.14 SQ. IN.

APPROX. 74 FT OF 2" PIPE AND HOSE IN THE SYSTEM, = 888 INCHES

CAPACITY = 3.14 SQ. IN. x 888 IN. = 2,788 CU. IN. = 12.07 GALLONS

8-15 ROSEDALE FILTER WATER CAPACITY

ROSEDALE FITER VOLUME = 500 CU. IN. = 2.2 GALLONS

400 LB SYSTEM TOTAL SPILL CAPACITY (GALLONS)

WATER CAPACITY = (2) VESSELS + PIPING + ROSEDALE FILTER
= (2) 33 GAL. + 12 GAL. + 2.2 GAL.
= 80.2 GALLONS

600 LB SYSTEM TOTAL SPILL CAPACITY (GALLONS)

WATER CAPACITY = (2) VESSELS + PIPING + ROSEDALE FILTER
= (2) 51 GAL. + 12 GAL. + 2.2 GAL.
= 116.2 GALLONS

BUILDING CONTAINMENT LIP WATER CAPACITY = 180 GALLONS
400 LB SYSTEM WATER CAPACITY = 80.2 GALLONS
600 LB SYSTEM WATER CAPACITY = 116.2 GALLONS

THEREFORE THE BUILDING CONTAINMENT LIPS WILL BE ABLE TO HOLD A TOTAL SPILL FROM EITHER SIZED SYSTEM.

APPENDIX F

OPERATION AND MAINTENANCE OF THE TEMPORARY DESIGNATED SOIL STOCKPILE

APPENDIX F

OPERATION AND MAINTENANCE OF THE TEMPORARY DESIGNATED SOIL STOCKPILE

The following activities shall be conducted and recorded at least monthly for the Temporary Designated Soil Stockpile:

- Measure the depth of water present in the sump.
- Conduct a walk-over inspection and note the condition of the HDPE cover material, including evidence of wear, bubbling, cracks, tears, pinholes.
- Inspect the condition of the manhole and the perimeter fence.
- Schedule any required maintenance or repairs identified or schedule pumping to lower the sump water level before it exceeds 40 inches above the base. Either treat removed water with one of the Category 5 fixed treatment systems or obtain approval from the North Shore Sanitary District for discharge to a sanitary sewer manhole.

Standard Operating Procedure - Water Level Depth Measurement in Temporary Designated Soil Stockpile Sump:

1. Remove the sump manhole cover or move it to one side with a crow bar or similar tool.
2. Place the measurement rod stick or staff gauge into the sump manhole in an area where the least amount of piping and hoses are located, making sure the rod touches bottom solidly. You should hear a solid sound and feel the rod on the bottom of the sump.
3. Remove the rod from the sump and observe the water mark on the wood.
4. Measure the distance of the water mark from the bottom of rod with a tape and record the depth of water. If there are permanent ruled markings on the rod or staff gauge, read and record the depth of water directly off the rod.
5. Store the rod near the manhole on the Temporary Designated Soil Stockpile and replace the manhole cover.